Solución a los ejercicios de geometría analítica

CAPÍTULO 1

EJERCICIO 1

1. $3u$
2. $4u$
3. $5\sqrt{3}u$
4. $\frac{5}{2}u$
5. $\frac{5}{4}u$
6. $1u$
7. $\frac{13}{24}u$
8. $\frac{17}{5}u$
9. $5a$
10. $\frac{13}{12}a$
11. $\overrightarrow{AB} = 7u$
12. $\overrightarrow{DC} = \frac{5}{4}u$
13. $\overrightarrow{AD} = \frac{5}{2}u$
14. $\overrightarrow{BA} = -7u$
15. $\overrightarrow{CB} = \frac{13}{4}u$
16. $\overrightarrow{DA} = -\frac{5}{2}u$
17. $\overrightarrow{DB} = \frac{9}{2}u$
18. $\overrightarrow{CA} = -\frac{15}{4}u$
19. $\overrightarrow{BC} = -\frac{13}{4}u$
20. $\overrightarrow{CD} = -\frac{5}{4}u$

EJERCICIO 2

1. $r = \frac{1}{3}$
2. $r = \frac{1}{4}$
3. $r = 1$
4. $r = -\frac{7}{2}$
5. $r = -\frac{4}{35}$
6. $r = \frac{3}{5}a$
7. $r = \frac{7}{3}$
8. $r = -\frac{7}{9}$
9. $x = -\frac{14}{3}$
10. $x = \frac{27}{4}$
11. $x = -\frac{5}{2}$
12. $x = \frac{5}{2}$
13. $x = -\frac{17}{20}$
14. $x = -\frac{23}{40}$

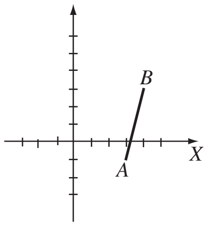
EJERCICIO 3

1. 1
2. $\frac{11}{2}$
3. -5
4. $-\frac{7}{12}$
5. $\frac{5}{12}$
6. $-\frac{7}{24}$
7. $\frac{3}{2}\sqrt{3}$
8. $-\frac{5}{24}a$
9. $-\frac{7}{4}$
10. $-\frac{3}{2}$

CAPÍTULO 2

EJERCICIO 4

1.



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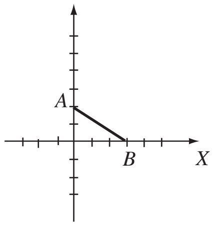

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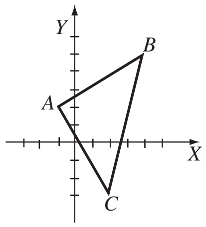

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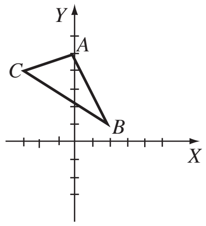

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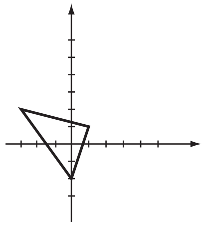

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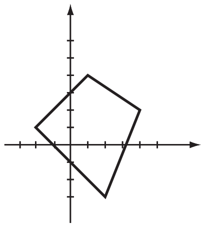


EJERCICIO 5

1. $10u$
2. $\sqrt{5}u$
3. $5\sqrt{2}u$
4. $4\sqrt{2}u$
5. $8u$
6. $\frac{\sqrt{181}}{6}u$
7. $\frac{5}{4}u$
8. $\frac{\sqrt{5}}{4}u$
9. $\frac{\sqrt{17}}{2}u$
10. $1u$
11. $28.72u$
12. $15.64u$
13. $25.10u$
14. $12u$
15. Es triángulo isósceles, debido a que $d_{AC} = d_{BC}$.
16. Perímetro = 40.96 u; Área = 133.517 u^2
17. Ordenada ($y = 11$, $y = 1$), puntos (– 4, 11) y (– 4,1)
18. $P(4, 6)$ y $P\left(-\frac{84}{13}, -\frac{126}{13}\right)$
19. sí
20. no
21. sí
22. no

EJERCICIO 6

1. $r = -\frac{1}{2}$
2. $r = -\frac{4}{3}$
3. $r = \frac{1}{2}$
4. $r = -2$
5. $r = -\frac{1}{10}$
6. $r = \frac{2}{7}$
7. $P(6, -5)$
8. $P(5, 0)$
9. $P\left(\frac{2}{5}, \frac{19}{5}\right)$
10. $P\left(-\frac{4}{9}, \frac{4}{3}\right)$
11. $P\left(4, -\frac{9}{2}\right)$
12. $P(-a, 3b)$
13. $r = -\frac{5}{2}$
14. $P\left(\frac{19}{5}, \frac{37}{5}\right)$
15. $P(3, 7)$
16. $r = 2$
17. $P(2, 1)$
18. $P\left(5, -\frac{11}{2}\right)$
19. $P_2\left(\frac{11}{3}, \frac{2}{3}\right)$
20. $P\left(\frac{2}{5}, \frac{7}{5}\right)$

21. $r = 1; x = \frac{x_1 + x_2}{2}; \; y = \frac{y_1 + y_2}{2}$
22. Los puntos de trisección son:

$$A\left(\frac{x_1 + 2x_2}{3}, \frac{y_1 + 2y_2}{3}\right)$$

$$B\left(\frac{2x_1 + x_2}{3}, \frac{2y_1 + y_2}{3}\right)$$

EJERCICIO 7

1. $Pm\left(\frac{5}{2}, 2\right); P_t: \left(\frac{8}{3}, 3\right)$ y $\left(\frac{7}{3}, 1\right)$
2. $Pm\left(\frac{3}{2}, \frac{11}{2}\right); P_t$: (1, 5) y (2, 6)
3. Pm (4, 7); $P_t: \left(\frac{7}{3}, \frac{17}{3}\right)$ y $\left(\frac{17}{3}, \frac{25}{3}\right)$
4. $Pm\left(8, -\frac{11}{2}\right); P_t$: (7, – 6) y (9, – 5)
5. $Pm\left(\frac{5}{12}, \frac{3}{2}\right); P_t: \left(\frac{4}{9}, \frac{4}{3}\right)$ y $\left(\frac{7}{18}, \frac{5}{3}\right)$
6. $Pm\left(\frac{11}{24}, -\frac{1}{2}\right); P_t: \left(\frac{7}{18}, 0\right)$ y $\left(\frac{19}{36}, -1\right)$
7. P_2(– 5, – 5)
8. (– 1, 1), (7, 9) y (– 3, 5)

EJERCICIO 8

1. $3u^2$	4. $10u^2$	7. $31u^2$	10. $50.5u^2$
2. $15u^2$	5. $6u^2$	8. $17u^2$	
3. $28.5u^2$	6. a^2u^2	9. $19u^2$	

CAPÍTULO 3

EJERCICIO 9

1. $\frac{2}{5}$	7. No existe	13. 30°
2. $-\frac{7}{5}$	8. $-\frac{17}{5}$	14. 35° 15’
		15. 90°
3. $-\frac{1}{8}$	9. $-\frac{5}{72}$	16. 0° o 180°
		17. Son colineales
4. $\frac{4}{3}$	10. $\frac{b}{a}$	18. Son colineales
	11. 45°	19. Son colineales
5. $-\frac{2}{3}$	12. 135°	20. No son colineales
6. 0		

21. Son colineales	24. Son colineales	27. $y = -3 + \sqrt{3}$
22. No son colineales	25. $x = \frac{2}{3}$	28. $y = -6$
23. Son colineales	26. $x = 4$	

EJERCICIO 10

1. Son perpendiculares
2. Los lados opuestos son paralelos y de igual pendiente

$$m_{BC} = m_{AD} = \frac{2}{5} \text{ y } m_{CD} = m_{AB} = 3$$

3. Las rectas son paralelas

$$m_{AB} = m_{CD} = -\frac{5}{3}$$

4. En un triángulo rectángulo los catetos son perpendiculares.

$$m_{AB} \cdot m_{AC} = \frac{1}{2} \cdot (-2) = -1$$

5. En un cuadrado los lados opuestos son paralelos y los lados adyacentes son perpendiculares.

$$m_{AB} = m_{CD} = 4, \; m_{BC} = m_{AD} = -\frac{1}{4} \text{ y } m_{AC} \cdot m_{BD} = -1$$

6. $x = 5$
7. $m_{AB} = m_{CD} = -2; \; m_{BC} = m_{AD} = \frac{2}{7}$

EJERCICIO 11

1. α = 57° 5’ 41”
2. 26° 33’ 54”, 116° 33’ 54”
   36° 52’ 11”
3. 63° 26’ 5”, 63° 26’ 5” y
   53° 7’ 48”
4. Un ángulo de 90°
   los restantes de 45°
5. 63° 26’ 5” y 26° 33’ 54”
6. α = 131° 49’ 12”
7. 130° 14’ 10”; 49° 45’ 50”
8. 117° 16’ 36”
9. $m_1 = \frac{2}{\sqrt{3}} = \frac{2\sqrt{3}}{3}$
10. $x = 8$
11. $m_1 = -\frac{1}{7}, m_2 = 7$
12. $-2 + \sqrt{3}; \; 2 + \sqrt{3}$

CAPÍTULO 4

EJERCICIO 12

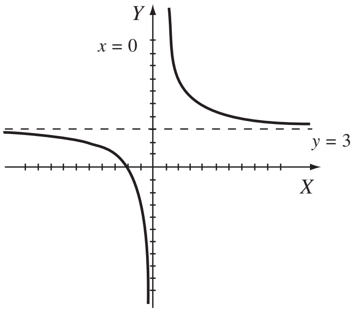
1. Intersecciones con los ejes: (– 2, 0)

   Simetría: No existe

   Extensión: $\{x \in R \mid x \neq 0\}$; $\{y \in R \mid y \neq 3\}$

   Asíntotas: Horizontal: $y = 3$, Vertical: $x = 0$

   Gráfica



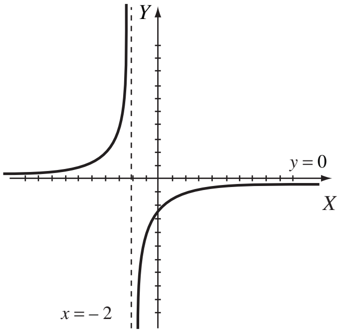
2. Intersecciones con los ejes: (0, – 2)

   Simetría: No existe

   Extensión: $\{x \in R \mid x \neq -2\}$; $\{y \in R \mid y \neq 0\}$

   Asíntotas: Horizontal: $y = 0$, Vertical: $x = -2$

   Gráfica



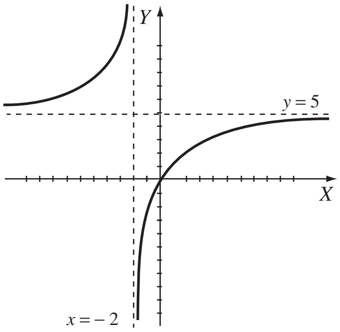
3. Intersecciones con los ejes: (0, 0)

   Simetría: No existe

   Extensión: $\{x \in R \mid x \neq -2\}$; $\{y \in R \mid y \neq 5\}$

   Asíntotas: Horizontal: $y = 5$, Vertical: $x = -2$

   Gráfica



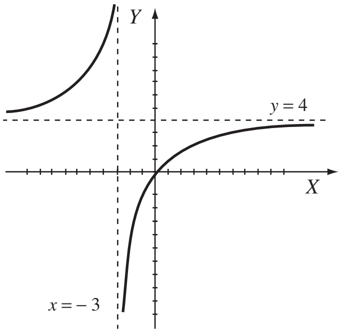
4. Intersecciones con los ejes: (0, 0)

   Simetría: No existe

   Extensión: $\{x \in R \mid x \neq -3\}$; $\{y \in R \mid y \neq 4\}$

   Asíntotas: Horizontal: $y = 4$, Vertical: $x = -3$

   Gráfica



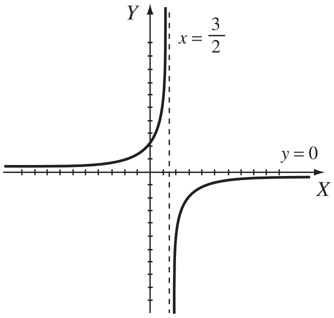
5. Intersecciones con los ejes: (0, 2)

   Simetría: No existe

   Extensión: $\left\{x \in R \mid x \neq \frac{3}{2}\right\}$; $\{y \in R \mid y \neq 0\}$

   Asíntotas: Horizontal: $y = 0$, Vertical: $x = \frac{3}{2}$

   Gráfica



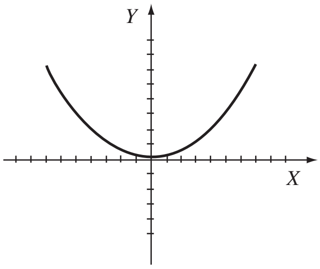
6. Intersecciones con los ejes: (0, 0)

   Simetría: Sólo con el eje Y

   Extensión: $\{x \in R\}$; $\{y \in R \mid y \geq 0\}$

   Asíntotas: No existen

   Gráfica



7. Intersecciones con los ejes: Eje $X \rightarrow (-4, 0), (4, 0)$

Eje $Y \rightarrow (0, 2), (0, -2)$

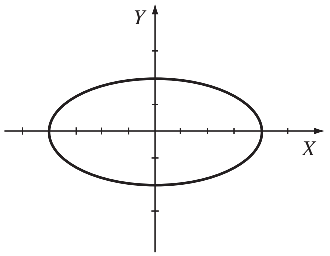
Simetría: Es simétrica con ambos ejes y con el origen

Extensión: $\{x \in R \mid -4 \leq x \leq 4\}$

$\{y \in R \mid -2 \leq y \leq 2\}$

Asíntotas: No existen

Gráfica



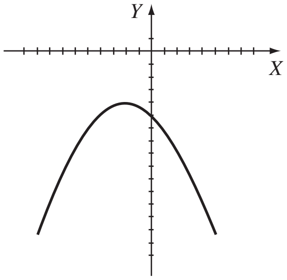
8. Intersecciones con los ejes: $(0, -5)$

Simetría: No existe

Extensión: $\{x \in R\}$; $\{y \in R \mid y \leq -4\}$

Asíntotas: No existen

Gráfica



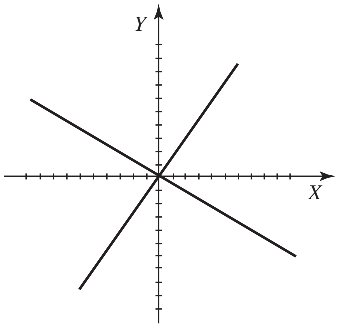
9. Intersecciones con los ejes: $(0, 0)$

Simetría: Sólo respecto al origen

Extensión: $\{x \in R\}$; $\{y \in R\}$

Asíntotas: No existen

Gráfica



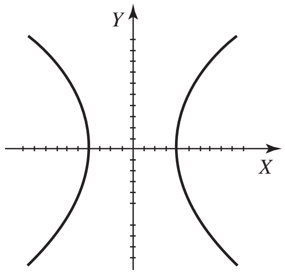
10. Intersecciones con los ejes: Eje $X \rightarrow (-4, 0), (4, 0)$

Simetría: Es simétrica con los ejes y con el origen

Extensión: $\{x \in R \mid x \leq -4 \text{ o } x \geq -4\}$; $\{y \in R\}$

Asíntotas: No hay horizontales o verticales

Gráfica



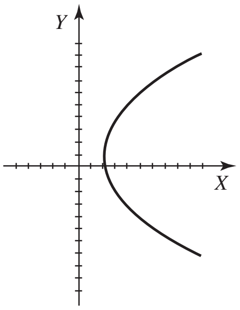
11. Intersecciones con los ejes: $\left(\frac{17}{8}, 0\right)$

Simetría: No existe

Extensión: $\{x \in R \mid x \geq 2\}$; $\{y \in R\}$

Asíntotas: No existen

Gráfica



12. Intersecciones con los ejes: $(0, 0)$ y $(6, 0)$

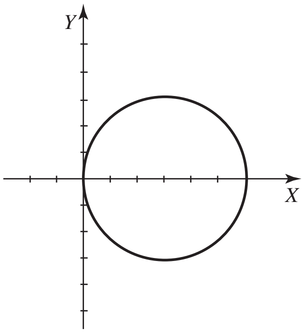
Simetría: Sólo con el eje X

Extensión: $\{x \in R \mid 0 \leq x \leq 6\}$

$\{y \in R \mid -3 \leq y \leq 3\}$

Asíntotas: No existen

Gráfica



EJERCICIO 13

1. $y - x = 2$
2. $xy = 1$
3. $x - 2y = 0$
4. $x^2 + y^2 = 25$
5. $7x - 3y + 4 = 0$
6. $x^2 + y^2 - 8x + 6y = 0$
7. $x^2 + 10y + 25 = 0$
8. $2x + y + 5 = 0$
9. $x^2 + y^2 + 6x + 4y - 51 = 0$
10. $x^2 + y^2 - 6x - 6y + 9 = 0$
11. $21x^2 - 12xy + 16y^2 + 60x + 60y - 600 = 0$
12. $9x^2 + 25y^2 - 225 = 0$
13. $28y^2 - 36x^2 - 63 = 0$; $36x^2 - 28y^2 + 63 = 0$
14. $16x^2 + 7y^2 - 112 = 0$
15. $7x^2 - 9y^2 - 28x + 90y - 260 = 0$

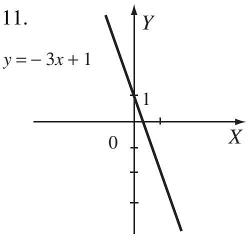
CAPÍTULO 5

EJERCICIO 14

1. $2x + 5y - 14 = 0$
2. $2x - y + 3 = 0$
3. $2y - 1 = 0$
4. $2x + 2y + 1 = 0$
5. $3x - 5y + 11 = 0$
6. $4x - 3y + 6 = 0$
7. $x - 3 = 0$
8. $8x - 4y - 7 = 0$
9. $3x + 2y - 2 = 0$
10. $3x + 5y - 12 = 0$
11. $3x + 2y - 5 = 0$
12. $\sqrt{3}x + y - 3\sqrt{3} = 0$
13. $x + y - 4 = 0$
14. $x - 3 = 0$
15. $x + 4 = 0$
16. $3x - 2y - 12 = 0$
17. $x + 4y + 2 = 0$
18. $2x + y = 0$
    $3x - 4y + 11 = 0$
    $5x + 2y - 25 = 0$
    $y = 0$
19. $2x + y - 4 = 0$
20. $6x + 5y - 82 = 0$
21. $2x - 3y + 8 = 0$
22. $4x - 7y + 10 = 0$
    $7x - 5y - 26 = 0$
    $3x + 2y + 22 = 0$
23. $4x - 6y - 5 = 0$
24. $10x - 3y - 4 = 0$
25. $2x - 3y - 7 = 0$
26. $2x + 11y + 5 = 0$
    $5x - 16y - 31 = 0$
27. (8, 6), (– 2, – 8), (– 6, – 2)
28. (–3, 0), (3, 2), (4, –2)
29. (–3, 2), (–1, –2)
    (7, 0), (5, 4)
30. $120x - y = 0$
31. $3t - 2v + 4 = 0$
32. $x + 40y - 600 = 0$
33. $120x - y + 1\,200 = 0$
34. $9T_C - 5T_F + 160 = 0$

EJERCICIO 15

1. $y = -x + 4$; $\frac{x}{4} + \frac{y}{4} = 1$
2. $y = \frac{2}{5}x + 1$; $\frac{x}{-5/2} + \frac{y}{1} = 1$
3. $y = \frac{1}{3}x + \frac{8}{3}$; $\frac{x}{-8} + \frac{y}{8/3} = 1$
4. $y = 2x$
5. $y = -\frac{1}{8}x + \frac{1}{2}$; $\frac{x}{4} + \frac{y}{1/2} = 1$
6. $y = \frac{3}{4}x - 3$; $\frac{x}{4} + \frac{y}{-3} = 1$
7. $y = -\frac{3}{5}x + 2$; $\frac{x}{10/3} + \frac{y}{2} = 1$
8. $y = -\frac{1}{6}x - \frac{5}{3}$; $\frac{x}{-10} + \frac{y}{-5/3} = 1$
9. $y = \frac{6}{5}x + 12$; $\frac{x}{-10} + \frac{y}{12} = 1$
10. $y = -x\ ctg\ w + p\ csc\ w$; $\frac{x}{p\ sec\ w} + \frac{y}{p\ csc\ w} = 1$

11.


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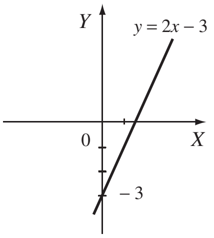

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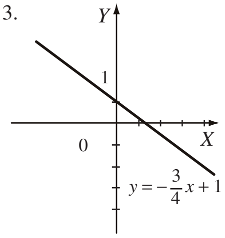

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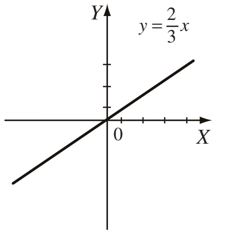

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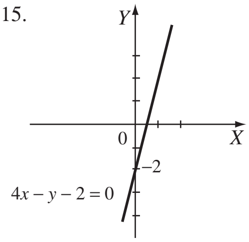

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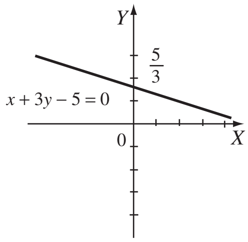

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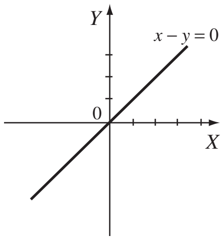

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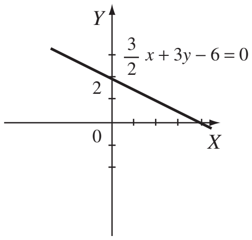
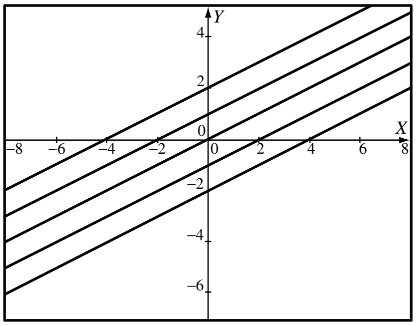
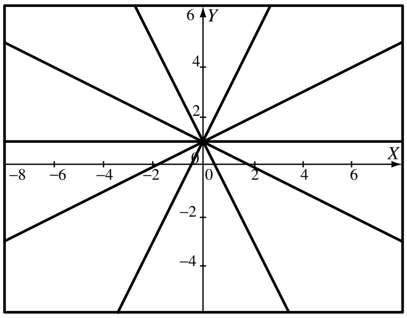


19. $x + y + 5 = 0$
20. $y = 2x + 4$
21. $y = -3x + 11$
22. $y = -\frac{1}{6}x + \frac{13}{6}$
23. $y = 5x + 5$
24. $5x - 3y + 20 = 0$
25. $4x + y - 15 = 0$
26. $x - y + 1 = 0$
27. $6x + 4y + 5 = 0$
28. $3x - 2y - 6 = 0$
29. 161° 33’ 54”
30. 36° 1’ 38”
    102° 20’ 20”
    41° 38’
31. (20, 13)
32. *a)* $y = 50x + 30\,000$
    b) \$70 000.00
33. *a)* $4m/s^2$
    b) $31m/s$
34. *a)* $C = 30x + 6\,000$
    b) \$1 000.00
    c) no
    d) 120 platillos
35. $\frac{x}{5} + \frac{y}{-5} = 1$
36. $\frac{x}{8} + \frac{y}{-4} = 1$
37. $\frac{x}{-\frac{4}{3}} + \frac{y}{-\frac{4}{5}} = 1$
38. $\frac{x}{-\frac{7}{4}} + \frac{y}{\frac{7}{2}} = 1$
39. $\frac{x}{6/5} + \frac{y}{-\frac{3}{2}} = 1$

EJERCICIO 16

1.


2.


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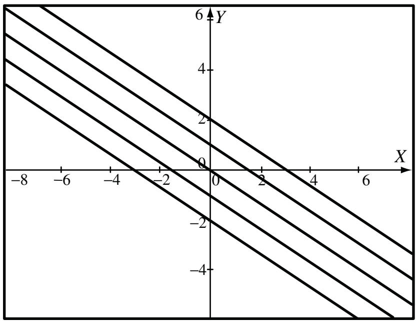

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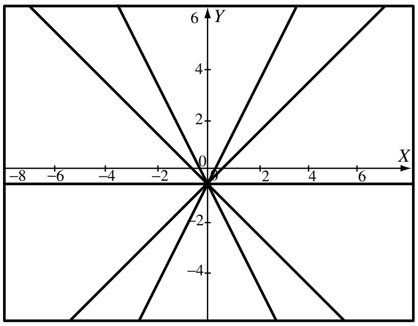

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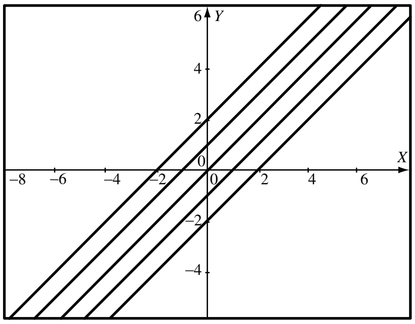

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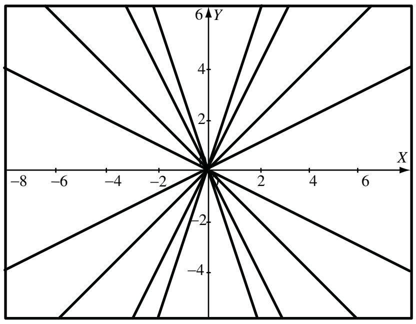
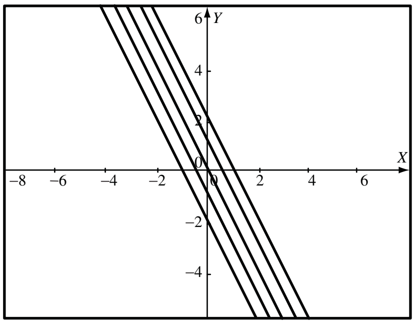
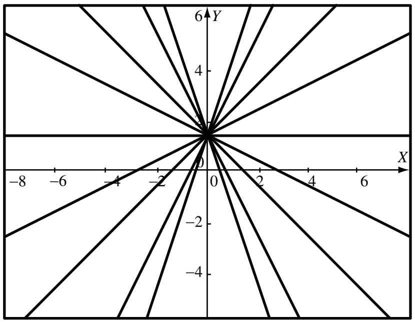
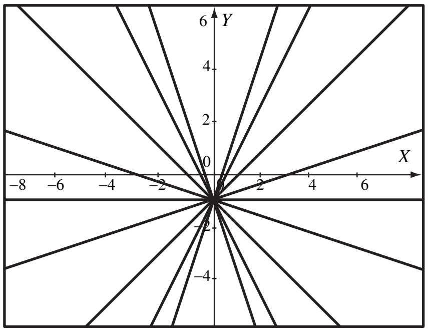
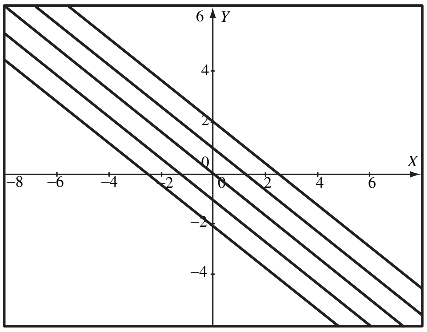


7. 

8. 

9. 

10. 

EJERCICIO 17

1. $\frac{2x}{\sqrt{13}}+\frac{3y}{\sqrt{13}}-\frac{5}{\sqrt{13}}=0$
2. $-\frac{x}{\sqrt{2}}+\frac{y}{\sqrt{2}}-\frac{5}{\sqrt{2}}=0$
3. $\frac{5x}{\sqrt{34}}+\frac{3y}{\sqrt{34}}=0$
4. $\frac{-x}{\sqrt{10}}+\frac{3y}{\sqrt{10}}-\frac{7}{\sqrt{10}}=0$
5. $-\frac{12x}{13}-\frac{5y}{13}-1=0$
6. $\frac{\sqrt{5}x}{3}+\frac{2y}{3}-\frac{1}{3}=0$
7. $\sqrt{3}x+y-8=0$
8. $x+y-2=0$
9. $x+\sqrt{3}y-6=0$
10. $x-\sqrt{3}y+2=0$
11. $x+\sqrt{3}=0$
12. $\sqrt{3}x-y+10=0$
13. $x+y+6=0$
14. $x-\sqrt{3}y-8\sqrt{3}=0$
15. $\frac{x}{2}-\frac{\sqrt{3}y}{2}-2=0$
16. $\frac{2x}{\sqrt{29}}+\frac{5y}{\sqrt{29}}-\frac{12}{\sqrt{29}}=0$
17. $-\frac{3x}{\sqrt{10}}-\frac{y}{\sqrt{10}}-\frac{7}{\sqrt{10}}=0$
18. $\theta=60°$, $\theta'=120°$
19. $3x-4y-12=0$

    $3x+4y+12=0$

EJERCICIO 18

1. $\frac{23\sqrt{53}}{53}$
2. $\frac{9}{5}$
3. $5\sqrt{2}$
4. $\frac{49}{13}$
5. $\frac{7\sqrt{2}}{2}$
6. 1
7. $\frac{32\sqrt{17}}{17}$
8. 10
9. $\frac{9\sqrt{10}}{5}$
10. $5u^2$
11. $r=\frac{7}{5}$
12. $K_1=2$

    $K_2=\frac{1}{2}$
13. $\frac{2\sqrt{13}}{13}$
14. $-\frac{6}{5}$
15. $\frac{14}{5}$
16. $\frac{11\sqrt{29}}{29}$
17. $-\frac{7}{10}$
18. $-\frac{27\sqrt{2}}{8}$
19. $3x-4y-10=0$

    $3x-4y+20=0$
20. $y=-\sqrt{17}+\frac{7}{4}$

    $y=\sqrt{17}+\frac{7}{4}$
21. $\frac{7\sqrt{5}}{5}$
22. $\frac{11\sqrt{5}}{15}$
23. $x-y-3-3\sqrt{2}=0$

    $x-y-3+3\sqrt{2}=0$
24. $2x-y-1=0$

    $2x+y-7=0$

EJERCICIO 19

1. $2x - y + 3 = 0$
2. $4x - 6y + 13 = 0$
3. $x + 3y - 9 = 0$
4. $y + 6 = 0$
5. $2x - 6y - 11 = 0$; $6x + 2y - 1 = 0$
6. $99x - 27y + 50 = 0$; $21x + 77y - 80 = 0$
7. $y - 2 = 0$; $7x - y - 5 = 0$; $x + y - 3 = 0$; $(1, 2)$
8. $2x + y - 6 = 0$; $x - 6y - 10 = 0$; $3x - 5y - 16 = 0$; $\left(\frac{46}{13}, -\frac{14}{13}\right)$
9. $2x + y - 3 = 0$; $3x - 5y + 16 = 0$; $x - 6y + 19 = 0$; $\left(-\frac{1}{13}, \frac{41}{13}\right)$
10. $11x + 4y - 27 = 0$; $7x - y - 16 = 0$; $4x + 5y - 11 = 0$; $\left(\frac{7}{3}, \frac{1}{3}\right)$
11. $\left(5\sqrt{5} - \sqrt{34}\right)x + \left(3\sqrt{5} + 2\sqrt{34}\right)y - \left(4\sqrt{5} + 7\sqrt{34}\right) = 0$

    $\left(\sqrt{37} + 6\sqrt{5}\right)x + \left(\sqrt{5} - 2\sqrt{37}\right)y + \left(7\sqrt{37} - 23\sqrt{5}\right) = 0$

    $\left(5\sqrt{37} + 6\sqrt{34}\right)x + \left(3\sqrt{37} + \sqrt{34}\right)y - \left(4\sqrt{37} + 23\sqrt{34}\right) = 0$

    $(1.5965, 2.2438)$
12. $55x + 47y - 144 = 0$

CAPÍTULO 6

EJERCICIO 20

1. $x^2 + y^2 - 16 = 0$
2. $4x^2 + 4y^2 - 3 = 0$
3. $x^2 + y^2 - 2x + 6y + 6 = 0$
4. $3x^2 + 3y^2 + 3x + 4y = 0$
5. $x^2 + y^2 - 13 = 0$
6. $x^2 + y^2 - 2x - 6y - 31 = 0$
7. $x^2 + y^2 - 2x + 6y - 35 = 0$
8. $x^2 + y^2 + 2x + 10y + 25 = 0$
9. $x^2 + y^2 - 10x + 4y = 0$
10. $x^2 + y^2 + 8x - 4y + 4 = 0$
11. $x^2 + y^2 - 10x + 10y + 25 = 0$
12. $3x^2 + 3y^2 + 13x - 65 = 0$
13. $4x^2 + 4y^2 + 41y + 66 = 0$
14. $x^2 + y^2 + 4y = 0$
15. $x^2 + y^2 - 8x + 6y + 21 = 0$
16. $x^2 + y^2 - 2x - 4y - 11 = 0$
17. $x^2 + y^2 + 6x + 8y - 144 = 0$
18. $x^2 + y^2 - 2x - 4y - 59 = 0$
19. $2x^2 + 2y^2 + 15x - 11y - 51 = 0$
20. $17x^2 + 17y^2 - 88x + 58y - 544 = 0$
21. $9x^2 + 9y^2 - 43x + 9y - 140 = 0$
22. $x^2 + y^2 - 4x + 4y - 2 = 0$
23. $x^2 + y^2 - 2x - 4y - 4 = 0$
24. $3x^2 + 3y^2 + 8x + 10y - 43 = 0$
25. $3x^2 + 3y^2 - x + 7y - 10 = 0$
26. $x^2 + y^2 - 6x + 4y - 5 = 0$
27. $x^2 + y^2 + 4x - 2y - 29 = 0$

EJERCICIO 21

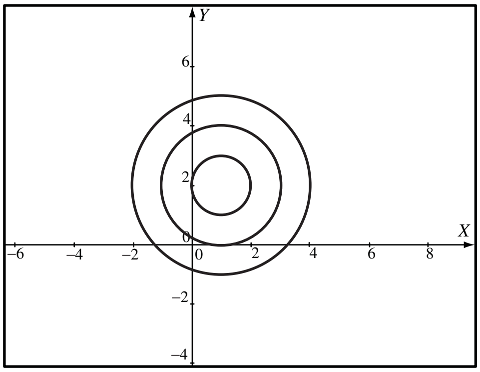
1. $C(-1, -1)$, $r = 2$
2. $C(3, -4)$, $r = \sqrt{5}$
3. Punto, $C(-3, -1)$, $r = 0$
4. Imaginaria con $C(2, -1)$ y $r = \sqrt{-9}$
5. $C(-7, 4)$, $r = 5$
6. $C(0, 4)$, $r = 3$
7. $C(-2, 0)$, $r = 1$
8. $C\left(-\frac{5}{2}, \frac{3}{2}\right)$, $r = \sqrt{7}$
9. $C\left(\frac{1}{2}, -\frac{3}{2}\right)$, $r = \frac{1}{2}$
10. $C\left(\frac{1}{5}, 3\right)$, $r = \frac{4}{5}$
11. $C\left(\frac{3}{4}, -\frac{1}{6}\right)$, $r = \frac{5}{12}$
12. $C\left(-\frac{2}{3}, \frac{1}{2}\right)$, $r = 3$
13. $x - 3y + 8 = 0$

    $79x + 3y - 568 = 0$
14. $x^2 + y^2 - 8x - 4y + 10 = 0$
15. $x^2 + y^2 - 8x - 8y + 19 = 0$

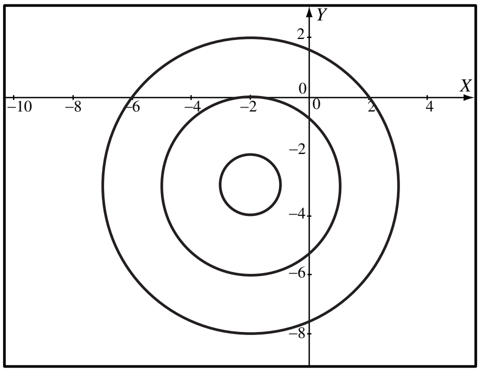
    $x^2 + y^2 + 4y - 9 = 0$
16. $x^2 + y^2 + 10x - 4 = 0$
17. $k = 5$, $k = -\frac{19}{17}$
18. $(-5, 3)$ y $(1, 9)$
19. $(2, 2)$
20. No existe intersección
21. $(3, 5)$ y $(4, 4)$
22. $(4, -1)$ y $(6, -3)$

EJERCICIO 22

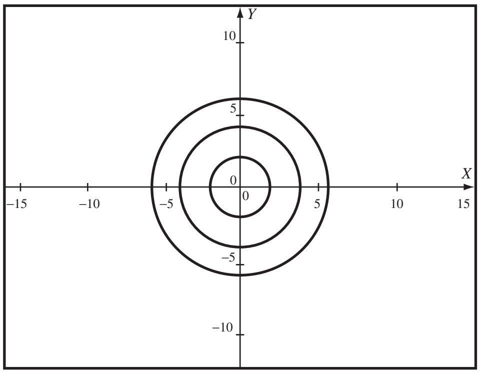
1.



2.



3.



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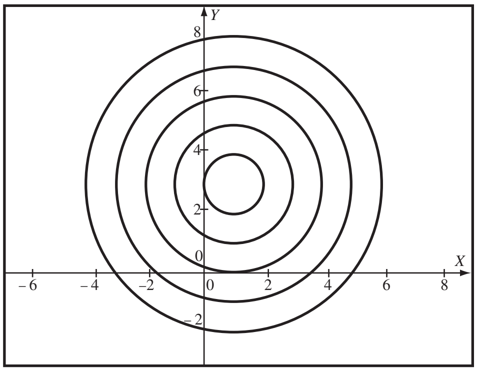

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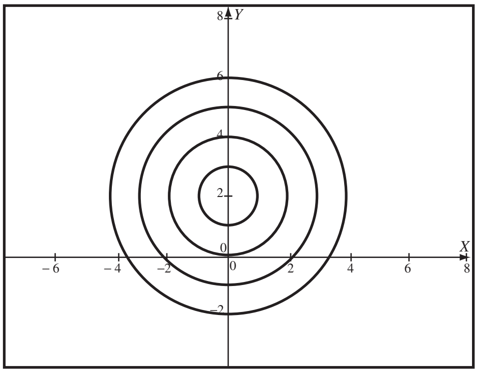

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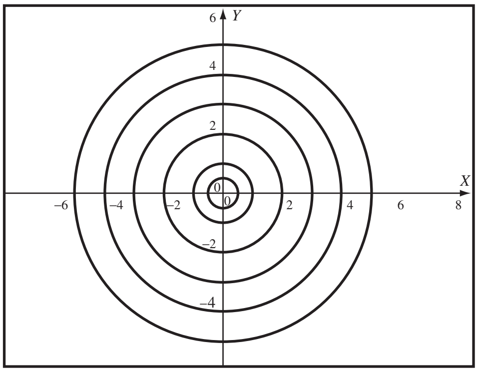

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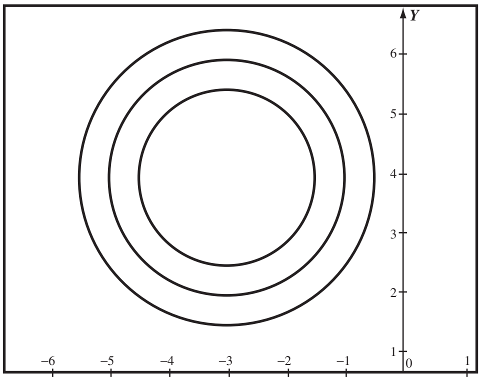
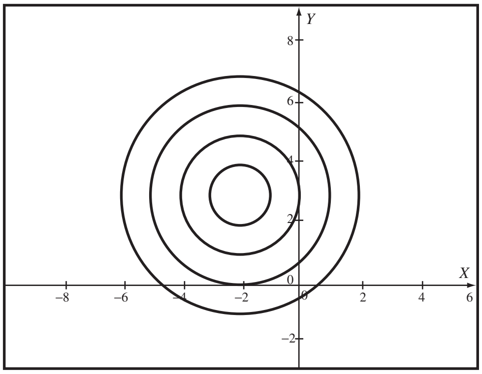


8.



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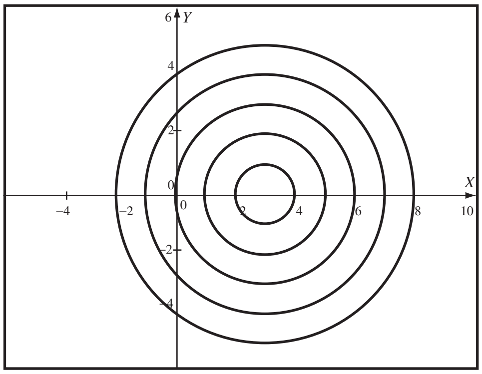

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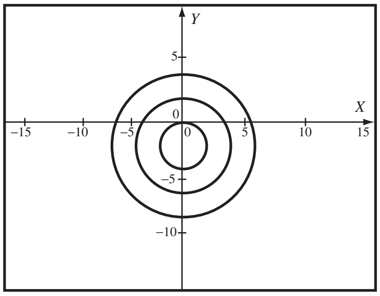


11. $(x-1)^2+(y-1)^2=p^2$

12. $(x+1)^2+(y+3)^2=p^2$

13. $(x+2)^2+(y-3)^2=p^2$

14. $(x-1)^2+(y-0)^2=p^2$

CAPÍTULO 7

EJERCICIO 23

1. (2, 2)
2. (9, 1)
3. (– 1, 4)
4. (– 10, – 4)
5. (– 8, 7)
6. $y'^2-8x'=0$
7. $x'^2-4y'=0$
8. $x'^2+y'^2-9=0$
9. $x'^2+y'^2-25=0$
10. $y'^2-12x'=0$
11. $9x'^2+16y'^2-144=0$
12. $4x'^2+5y'^2-20=0$
13. $9x'^2+4y'^2-72=0$
14. $x'^2-2y'^2-2=0$
15. $4x'^2-9y'^2-36=0$
16. $y'=x'^3$
17. $y'^2=x'^3-1$

EJERCICIO 24

1. $x'^2-8y'=0$
2. $y'^2-16x'=0$
3. $x'^2+y'^2-8=0$
4. $x'^2+y'^2-4=0$
5. $9x'^2+4y'^2-36=0$
6. $16x'^2+16y'^2-9=0$
7. $25x'^2-16y'^2+400=0$
8. $y'^3-x'=0$

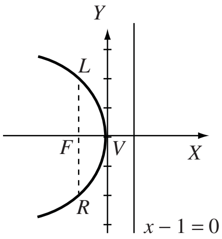
CAPÍTULO 8

EJERCICIO 25

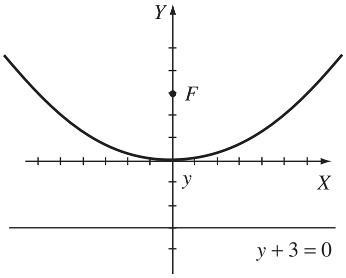
1. $y^2+8x=0$
2. $x^2+4y=0$
3. $y^2-12x+2y+1=0$
4. $x^2-16y=0$
5. $x^2-4x+4y-16=0$
6. $y^2+12x-4y+52=0$
7. $x^2-2xy+y^2+8x-4y+2=0$
8. $9x^2-12xy+4y^2-48x+32y+64=0$

EJERCICIO 26

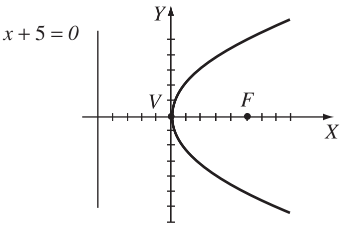
1. Foco: $F(-1, 0)$, Directriz: $x-1=0$, $LR=4$,
   Eje: $y=0$



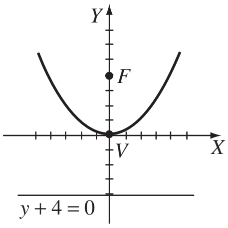
2. Foco: $F(0, 3)$, Directriz: $y+3=0$, $LR=12$,
   Eje: $x=0$



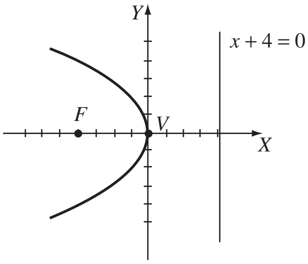
3. Foco: $F(5, 0)$, Directriz: $x+5=0$, $LR=20$,
   Eje: $y=0$



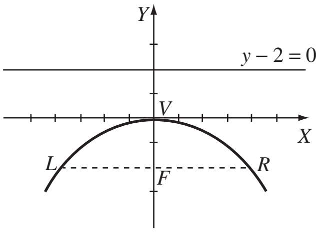
4. Foco: $F(0, 4)$, Directriz: $y + 4 = 0$, $LR = 16$,
Eje: $x = 0$



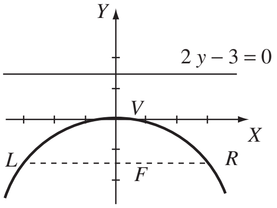
5. Foco: $F(-4, 0)$, Directriz: $x - 4 = 0$, $LR = 16$,
Eje: $y = 0$



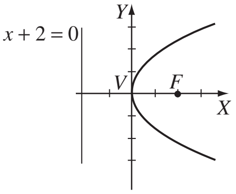
6. Foco: $F(0, -2)$, Directriz: $y - 2 = 0$, $LR = 8$,
Eje: $x = 0$



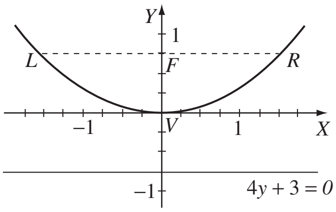
7. Foco: $F\left(0,-\frac{3}{2}\right)$, Directriz: $2y - 3 = 0$, $LR = 6$,
Eje: $x = 0$



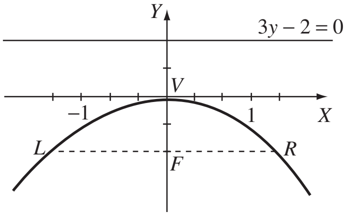
8. Foco: $F(2, 0)$, Directriz: $x + 2 = 0$, $LR = 8$,
Eje: $y = 0$



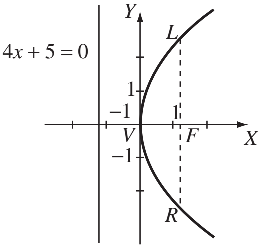
9. Foco: $F\left(0,\frac{3}{4}\right)$, Directriz: $4y + 3 = 0$, $LR = 3$,
Eje: $x = 0$



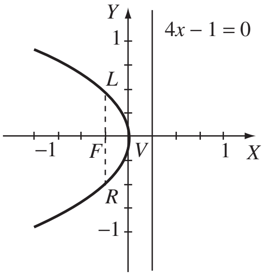
10. Foco: $\left(0,-\frac{2}{3}\right)$, Directriz: $3y - 2 = 0$, $LR = \frac{8}{3}$,
Eje: $x = 0$



11. Foco: $F\left(\frac{5}{4},0\right)$, Directriz: $4x + 5 = 0$, $LR = 5$,
Eje: $y = 0$

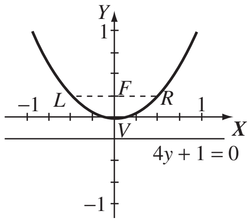


12. Foco: $\left(-\frac{1}{4},0\right)$, Directriz: $4x - 1 = 0$, $LR = 1$,
Eje: $y = 0$



13. Foco: $F\left(0,\frac{1}{4}\right)$, Directriz: $4y + 1 = 0$, $LR = 1$

Eje: $x = 0$



14. $y^2 + 20x = 0$
15. $x^2 - 24y = 0$
16. $y^2 - 8x = 0$
17. $x^2 + 4y = 0$
18. $y^2 + 2x = 0$
19. $3x^2 + 28y = 0$
20. $x^2 - 8y = 0$
21. $y^2 + 24x = 0$
22. $x^2 + 10y = 0$
23. $y^2 + 6x = 0$
24. $3y^2 - 16x = 0$
25. $x^2 - y = 0$
26. $y^2 + 18x = 0$
27. $x^2 + 4y = 0$
28. $3y^2 - 16x = 0$
29. $3x^2 + 16y = 0$
30. $3\sqrt{13}$ unidades
31. $5\sqrt{2}$ unidades
32. $2x^2 - y = 0$, $y^2 - 4x = 0$
33. $y^2 + 3x = 0$, $y^2 - 3x = 0$
34. $y^2 - 12x = 0$
35. $x^2 - 8y = 0$

Ejercicio 27

V: Vértice, F: Foco, LR: Lado recto, D: Directriz

1. $V(1, 5)$, $F(4, 5)$, $LR = 12$, D: $x + 2 = 0$, Eje: $y = 5$
2. $V(6, -2)$, $F(6, -6)$, $LR = 16$, D: $y - 2 = 0$, Eje: $x = 6$
3. $V(-2, -4)$, $F(-7, -4)$, $LR = 20$, D: $x - 3 = 0$, Eje: $y = -4$
4. $V(-1, 5)$, $F(-1, 4)$, $LR = 4$, D: $y - 6 = 0$, Eje: $x = -1$
5. $V(-2, 0)$, $F(0, 0)$, $LR = 8$, D: $x + 4 = 0$, Eje: $y = 0$
6. $V(0, 2)$, $F(0, 8)$, $LR = 24$, D: $y + 4 = 0$, Eje: $x = 0$
7. $V(-4, 2)$, $F\left(-4,\frac{7}{2}\right)$, $LR = 6$, D: $2y - 1 = 0$, Eje: $x = -4$
8. $V\left(\frac{4}{5},-3\right)$, $F\left(\frac{41}{20},-3\right)$, $LR = 5$, D: $20x + 9 = 0$, Eje: $y = -3$
9. $V\left(\frac{3}{2},2\right)$, $F\left(\frac{3}{2},3\right)$, $LR = 4$, D: $y - 1 = 0$, $x = \frac{3}{2}$
10. $V\left(2,-\frac{1}{4}\right)$, $F\left(\frac{19}{8},-\frac{1}{4}\right)$, $LR = \frac{3}{2}$, D: $x = \frac{13}{8}$, Eje: $y = -\frac{1}{4}$
11. $V\left(\frac{1}{2},-\frac{3}{2}\right)$, $F\left(\frac{1}{2},-\frac{1}{2}\right)$, $LR = 4$, D: $2y + 5 = 0$, Eje: $x = \frac{1}{2}$
12. $V(3, -1)$, $F\left(\frac{10}{3},-1\right)$, $LR = \frac{4}{3}$, D: $3x - 8 = 0$, Eje: $y = -1$
13. $V\left(0,\frac{1}{4}\right)$, $F\left(0,\frac{3}{4}\right)$, $LR = 2$, D: $4y + 1 = 0$, E: $x = 0$
14. $V(1, 0)$, $F\left(\frac{21}{16},0\right)$, $LR = \frac{5}{4}$, D: $16x - 11 = 0$, E: $y = 0$
15. $y^2 + 20x - 8y - 24 = 0$
16. $x^2 - 6x + 16y + 25 = 0$
17. $y^2 - 8x - 4y + 28 = 0$
18. $x^2 + 10x - 12y + 49 = 0$
19. $y^2 - 2x + 8y + 20 = 0$
20. $3x^2 + 18x - 28y - 29 = 0$
21. $y^2 + 24x - 12y - 60 = 0$
22. $x^2 - 8x - 16y + 32 = 0$
23. $y^2 + 8y - 20x + 36 = 0$
24. $x^2 + 28y - 28 = 0$
25. $y^2 + 14x - 4y + 25 = 0$
26. $x^2 - 14x - 10y + 54 = 0$
27. $x^2 - 2x - 8y - 23 = 0$
28. $x^2 + 6x - 24y + 129 = 0$
    $x^2 + 6x + 24y - 111 = 0$
29. $y^2 + 24x - 4y - 116 = 0$
30. $x^2 - 6x + 24y - 87 = 0$
31. $(4, 8)$, $(7, -4)$

Ejercicio 28

1. $y^2 - x + 2y + 1 = 0$
2. $y^2 - 4x = 0$
3. $3y^2 - x + 7 = 0$
4. $y^2 - x - 4 = 0$
5. $x^2 - 4x - y + 3 = 0$
6. $x^2 - y + 1 = 0$
7. $2x^2 + 3x - y + 1 = 0$
8. $x^2 + 6x - 2y + 5 = 0$

Ejercicio 29

1. $8\ m$
2. $62.5\ cm$
3. $18.75\ cm$
4. $27.71\ cm$
5. $x - y - 2 = 0$
6. $x - 4y + 24 = 0$
7. $2x - y - 9 = 0$
8. $x - 2y + 2 = 0$
9. $x - 3y - 3 = 0$
10. $2x - 3y - 16 = 0$

Capítulo 9

Ejercicio 30

1. $5x^2 + 9y^2 - 180 = 0$
2. $5x^2 + 9y^2 - 45 = 0$
3. $49x^2 + 24y^2 - 1176 = 0$
4. $25x^2 + 16y^2 + 100x - 128y - 44 = 0$
5. $9x^2 + 25y^2 - 18x + 100y - 791 = 0$

EJERCICIO 31

1. $V(\pm 2, 0)$, $F(\pm 1, 0)$, $B(0, \pm\sqrt{3})$, $LR = 3$, $e = \frac{1}{2}$,

   $\overline{V_1V_2} = 4$, $\overline{F_1F_2} = 2$ y $\overline{B_1B_2} = 2\sqrt{3}$

2. $V(0, \pm 3)$, $F(0, \pm 2)$, $B(\pm\sqrt{5}, 0)$, $LR = \frac{10}{3}$, $e = \frac{2}{3}$,

   $\overline{V_1V_2} = 6$, $\overline{F_1F_2} = 4$ y $\overline{B_1B_2} = 2\sqrt{5}$

3. $V(0, \pm 2\sqrt{3})$, $F(0, \pm\sqrt{7})$, $B(\pm\sqrt{5}, 0)$, $LR = \frac{5\sqrt{3}}{3}$,

   $e = \frac{\sqrt{21}}{6}$, $\overline{V_1V_2} = 4\sqrt{3}$, $\overline{F_1F_2} = 2\sqrt{7}$ y $\overline{B_1B_2} = 2\sqrt{5}$

4. $V(\pm 8, 0)$, $F(\pm 2\sqrt{15}, 0)$, $B(0, \pm 2)$, $LR = 1$, $e = \frac{\sqrt{15}}{4}$,

   $\overline{V_1V_2} = 16$, $\overline{F_1F_2} = 4\sqrt{15}$ y $\overline{B_1B_2} = 4$

5. $V(\pm 5, 0)$, $F(\pm 4, 0)$, $B(0, \pm 3)$, $LR = \frac{18}{5}$, $e = \frac{4}{5}$,

   $\overline{V_1V_2} = 10$, $\overline{F_1F_2} = 8$ y $\overline{B_1B_2} = 6$

6. $V(0, \pm 4)$, $F(0, \pm 2\sqrt{3})$, $B(\pm 2, 0)$, $LR = 2$, $e = \frac{\sqrt{3}}{2}$,

   $\overline{V_1V_2} = 8$, $\overline{F_1F_2} = 4\sqrt{3}$ y $\overline{B_1B_2} = 4$

7. $V(0, \pm\frac{5}{2})$, $F(0, \pm\frac{5\sqrt{5}}{6})$, $B(\pm\frac{5}{3}, 0)$, $LR = \frac{20}{9}$, $e = \frac{\sqrt{5}}{3}$,

   $\overline{V_1V_2} = 5$, $\overline{F_1F_2} = \frac{5\sqrt{5}}{3}$ y $\overline{B_1B_2} = \frac{10}{3}$

8. $V(0, \pm 1)$, $F(0, \pm\frac{\sqrt{3}}{2})$, $B(\pm\frac{1}{2}, 0)$, $LR = \frac{1}{2}$, $e = \frac{\sqrt{3}}{2}$,

   $\overline{V_1V_2} = 2$, $\overline{F_1F_2} = \sqrt{3}$, $\overline{B_1B_2} = 1$

9. $V(0, \pm\sqrt{3})$, $F(0, \pm 1)$, $B(\pm\sqrt{2}, 0)$, $LR = \frac{4\sqrt{3}}{3}$,

   $e = \frac{\sqrt{3}}{3}$, $\overline{V_1V_2} = 2\sqrt{3}$, $\overline{F_1F_2} = 2$ y $\overline{B_1B_2} = 2\sqrt{2}$

10. $V(0, \pm\frac{1}{3})$, $F(0, \pm\frac{\sqrt{7}}{12})$, $B(\pm\frac{1}{4}, 0)$, $LR = \frac{3}{8}$,

    $e = \frac{\sqrt{7}}{4}$, $\overline{V_1V_2} = \frac{2}{3}$, $\overline{F_1F_2} = \frac{\sqrt{7}}{6}$ y $\overline{B_1B_2} = \frac{1}{2}$

11. $V(\pm 4, 0)$, $F(\pm 3, 0)$, $B(0, \pm\sqrt{7})$, $LR = \frac{7}{2}$, $e = \frac{3}{4}$,

    $\overline{V_1V_2} = 8$, $\overline{F_1F_2} = 6$, $\overline{B_1B_2} = 2\sqrt{7}$

12. $V(\pm 1, 0)$, $F(\pm\frac{\sqrt{2}}{2}, 0)$, $B(0, \pm\frac{\sqrt{2}}{2})$, $LR = 1$,

    $e = \frac{\sqrt{2}}{2}$, $\overline{V_1V_2} = 2$, $\overline{F_1F_2} = \sqrt{2}$, $\overline{B_1B_2} = \sqrt{2}$

13. $V(0, \pm\sqrt{5})$, $F(0, \pm\sqrt{3})$, $B(\pm\sqrt{2}, 0)$, $LR = \frac{4\sqrt{5}}{5}$,

    $e = \frac{\sqrt{15}}{5}$, $\overline{V_1V_2} = 2\sqrt{5}$, $\overline{F_1F_2} = 2\sqrt{3}$ y $\overline{B_1B_2} = 2\sqrt{2}$

14. $V(0, \pm 2\sqrt{2})$, $F(0, \pm\sqrt{6})$, $B(\pm\sqrt{2}, 0)$, $LR = \sqrt{2}$,

    $e = \frac{\sqrt{3}}{2}$, $\overline{V_1V_2} = 4\sqrt{2}$, $\overline{F_1F_2} = 2\sqrt{6}$ y $\overline{B_1B_2} = 2\sqrt{2}$

15. $V(\pm 3, 0)$, $F(\pm\sqrt{6}, 0)$, $B(0, \pm\sqrt{3})$, $LR = 2$, $e = \frac{\sqrt{6}}{3}$,

    $\overline{V_1V_2} = 6$, $\overline{F_1F_2} = 2\sqrt{6}$ y $\overline{B_1B_2} = 2\sqrt{3}$

16. $V(0, \pm 2\sqrt{3})$, $F(0, \pm 2\sqrt{2})$, $B(\pm 2, 0)$, $LR = \frac{4\sqrt{3}}{3}$,

    $e = \frac{\sqrt{6}}{3}$, $\overline{V_1V_2} = 4\sqrt{3}$, $\overline{F_1F_2} = 4\sqrt{2}$ y $\overline{B_1B_2} = 4$

EJERCICIO 32

1. $5x^2 + 9y^2 - 180 = 0$
2. $7x^2 + 9y^2 - 63 = 0$
3. $x^2 + 5y^2 - 5 = 0$
4. $49x^2 + 24y^2 - 1176 = 0$
5. $3x^2 + y^2 - 3 = 0$
6. $16x^2 + 25y^2 - 400 = 0$
7. $7x^2 + 16y^2 - 112 = 0$
8. $4x^2 + 13y^2 - 52 = 0$
9. $9x^2 + 14y^2 - 126 = 0$
10. $3x^2 + 2y^2 - 12 = 0$
11. $5x^2 + y^2 - 5 = 0$
12. $65x^2 + 16y^2 - 1040 = 0$
13. $9x^2 + 5y^2 - 45 = 0$
14. $9x^2 + 25y^2 - 225 = 0$
15. $16x^2 + 7y^2 - 448 = 0$

16. $12x^2 + 16y^2 - 3 = 0$
17. $8x^2 + 9y^2 - 72 = 0$; $9x^2 + 8y^2 - 72 = 0$
18. $9x^2 + 4y^2 - 36 = 0$
19. $x^2 + 4y^2 - 16 = 0$
20. $9x^2 + 13y^2 - 117 = 0$
21. $x^2 + 4y^2 - 9 = 0$
22. $x^2 + 2y^2 - 2 = 0$; $2x^2 + y^2 - 2 = 0$

EJERCICIO 33

1. $C(2, 1)$, $V_1(2, 5)$, $V_2(2, -3)$, $F_1(2, 1+\sqrt{7})$, $F_2(2, 1-\sqrt{7})$

   $B_1(5, 1)$, $B_2(-1, 1)$, $LR = \frac{9}{2}$, $e = \frac{\sqrt{7}}{4}$, $\overline{V_1V_2} = 8$,

   $\overline{F_1F_2} = 2\sqrt{7}$, $\overline{B_1B_2} = 6$

2. $C\left(\frac{2}{3},1\right)$, $V_1\left(\frac{8}{3},1\right)$, $V_2\left(-\frac{4}{3},1\right)$, $F_1\left(\frac{2+3\sqrt{3}}{3},1\right)$,

   $F_2\left(\frac{2-3\sqrt{3}}{3},1\right)$, $B_1\left(\frac{2}{3},2\right)$, $B_2\left(\frac{2}{3},0\right)$, $LR = 1$, $e = \frac{\sqrt{3}}{2}$,

   $\overline{V_1V_2} = 4$, $\overline{F_1F_2} = 2\sqrt{3}$, $\overline{B_1B_2} = 2$

3. $C(-5, 1)$, $V_1(-2, 1)$, $V_2(-8, 1)$, $F_1(-5+\sqrt{6}, 1)$,

   $F_2(-5-\sqrt{6}, 1)$, $B_1(-5, 1+\sqrt{3})$, $B_2(-5, 1-\sqrt{3})$,

   $LR = 2$, $e = \frac{\sqrt{6}}{3}$, $\overline{V_1V_2} = 6$, $\overline{F_1F_2} = 2\sqrt{6}$, $\overline{B_1B_2} = 2\sqrt{3}$

4. $C(0, 2)$, $V_1(0, 7)$, $V_2(0, -3)$, $F_1(0, 5)$, $F_2(0, -1)$, $B_1(4, 2)$,

   $B_2(-4, 2)$, $LR = \frac{32}{5}$, $e = \frac{3}{5}$, $\overline{V_1V_2} = 10$, $\overline{F_1F_2} = 6$, $\overline{B_1B_2} = 8$

5. $C(5, -2)$, $V_1(9, -2)$, $V_2(1, -2)$, $F_1(5+\sqrt{15}, -2)$,

   $F_2(5-\sqrt{15}, -2)$, $B_1(5, -1)$, $B_2(5, -3)$, $LR = \frac{1}{2}$,

   $e = \frac{\sqrt{15}}{4}$, $\overline{V_1V_2} = 8$, $\overline{F_1F_2} = 2\sqrt{15}$, $\overline{B_1B_2} = 2$

6. $C(2, 3)$, $V_1(2, 9)$, $V_2(2, -3)$, $F_1(2, 3+3\sqrt{3})$,

   $F_2(2, 3-3\sqrt{3})$, $B_1(5, 3)$, $B_2(-1, 3)$, $LR = 3$, $e = \frac{\sqrt{3}}{2}$,

   $\overline{V_1V_2} = 12$, $\overline{F_1F_2} = 6\sqrt{3}$, $\overline{B_1B_2} = 6$

7. $C\left(-\frac{5}{2},\frac{3}{4}\right)$, $V_1\left(-\frac{5}{2},\frac{15}{4}\right)$, $V_2\left(-\frac{5}{2},-\frac{9}{4}\right)$,

   $F_1\left(-\frac{5}{2},\frac{3}{4}+\sqrt{5}\right)$, $F_2\left(-\frac{5}{2},\frac{3}{4}-\sqrt{5}\right)$, $B_1\left(-\frac{1}{2},\frac{3}{4}\right)$,

   $B_2\left(-\frac{9}{2},\frac{3}{4}\right)$, $LR = \frac{8}{3}$, $e = \frac{\sqrt{5}}{3}$, $\overline{V_1V_2} = 6$,

   $\overline{F_1F_2} = 2\sqrt{5}$, $\overline{B_1B_2} = 4$

8. $C(1, 2)$, $V_1(4, 2)$, $V_2(-2, 2)$, $F_1(1+\sqrt{5}, 2)$, $F_2(1-\sqrt{5}, 2)$,

   $B_1(1, 4)$, $B_2(1, 0)$, $LR = \frac{8}{3}$, $e = \frac{\sqrt{5}}{3}$, $\overline{V_1V_2} = 6$,

   $\overline{F_1F_2} = 2\sqrt{5}$, $\overline{B_1B_2} = 4$

9. $C\left(-\frac{7}{3},\frac{3}{4}\right)$, $V_1\left(-2,\frac{3}{4}\right)$, $V_2\left(-\frac{8}{3},\frac{3}{4}\right)$,

   $F_1\left(\frac{-28+\sqrt{7}}{12},\frac{3}{4}\right)$, $F_2\left(\frac{-28-\sqrt{7}}{12},\frac{3}{4}\right)$, $B_1\left(-\frac{7}{3},1\right)$,

   $B_2\left(-\frac{7}{3},\frac{1}{2}\right)$, $LR = \frac{3}{8}$, $e = \frac{\sqrt{7}}{4}$, $\overline{V_1V_2} = \frac{2}{3}$,

   $\overline{F_1F_2} = \frac{\sqrt{7}}{6}$, $\overline{B_1B_2} = \frac{1}{2}$

10. $C\left(-\frac{5}{3},-\frac{7}{2}\right)$, $V_1\left(-\frac{5}{3},\frac{-7+2\sqrt{3}}{2}\right)$,

    $V_2\left(-\frac{5}{3},\frac{-7-2\sqrt{3}}{2}\right)$, $F_1\left(-\frac{5}{3},-\frac{5}{2}\right)$, $F_2\left(-\frac{5}{3},-\frac{9}{2}\right)$,

    $B_1\left(\frac{-5+3\sqrt{2}}{3},-\frac{7}{2}\right)$, $B_2\left(\frac{-5-3\sqrt{2}}{3},-\frac{7}{2}\right)$,

    $LR = \frac{4\sqrt{3}}{3}$, $e = \frac{\sqrt{3}}{3}$, $\overline{V_1V_2} = 2\sqrt{3}$, $\overline{F_1F_2} = 2$,

    $\overline{B_1B_2} = 2\sqrt{2}$

11. $C(-3, 2)$ $V_1(0, 2)$, $V_2(-6, 2)$ $F_1(-1, 2)$, $F_2(-5, 2)$,

    $B_1(-3, 2+\sqrt{5})$, $B_2(-3, 2-\sqrt{5})$, $LR = \frac{10}{3}$, $e = \frac{2}{3}$,

    $\overline{V_1V_2} = 6$, $\overline{F_1F_2} = 4$, $\overline{B_1B_2} = 2\sqrt{5}$

12. $C\left(-\frac{5}{2},\frac{4}{3}\right)$, $V_1\left(\frac{1}{2},\frac{4}{3}\right)$, $V_2\left(-\frac{11}{2},\frac{4}{3}\right)$,

$F_1\left(\frac{-5+2\sqrt{5}}{2},\frac{4}{3}\right)$, $F_2\left(\frac{-5-2\sqrt{5}}{2},\frac{4}{3}\right)$,

$B_1\left(-\frac{5}{2},\frac{10}{3}\right)$, $B_2\left(-\frac{5}{2},-\frac{2}{3}\right)$, $LR=\frac{8}{3}$, $e=\frac{\sqrt{5}}{3}$,

$\overline{V_1V_2}=6$, $\overline{F_1F_2}=2\sqrt{5}$, $\overline{B_1B_2}=4$

13. $C\left(-\frac{1}{2},\frac{12}{5}\right)$, $V_1\left(\frac{9}{2},\frac{12}{5}\right)$, $V_2\left(-\frac{11}{2},\frac{12}{5}\right)$

$F_1\left(\frac{-1+2\sqrt{21}}{2},\frac{12}{5}\right)$, $F_2\left(\frac{-1-2\sqrt{21}}{2},\frac{12}{5}\right)$,

$B_1\left(-\frac{1}{2},\frac{22}{5}\right)$, $B_2\left(-\frac{1}{2},\frac{2}{5}\right)$, $LR=\frac{8}{5}$, $e=\frac{\sqrt{21}}{5}$,

$\overline{V_1V_2}=10$, $\overline{F_1F_2}=2\sqrt{21}$, $\overline{B_1B_2}=4$

14. $C(0,-1)$, $V_1(1,-1)$, $V_2(-1,-1)$, $F_1\left(\frac{\sqrt{3}}{2},-1\right)$,

$F_2\left(-\frac{\sqrt{3}}{2},-1\right)$, $B_1\left(0,-\frac{1}{2}\right)$, $B_2\left(0,-\frac{3}{2}\right)$, $LR=\frac{1}{2}$,

$e=\frac{\sqrt{3}}{2}$, $\overline{V_1V_2}=2$, $\overline{F_1F_2}=\sqrt{3}$, $\overline{B_1B_2}=1$

15. $C(-2,0)$, $V_1(-2,2)$, $V_2(-2,-2)$, $F_1(-2,1)$, $F_2(-2,-1)$,

$B_1\left(-2+\sqrt{3},0\right)$, $B_2\left(-2-\sqrt{3},0\right)$, $LR=3$,

$e=\frac{1}{2}$, $\overline{V_1V_2}=4$, $\overline{F_1F_2}=2$, $\overline{B_1B_2}=2\sqrt{3}$

16. $C\left(-\frac{3}{2},\frac{1}{3}\right)$, $V_1\left(-\frac{3}{2},\frac{13}{3}\right)$, $V_2\left(-\frac{3}{2},-\frac{11}{3}\right)$,

$F_1\left(-\frac{3}{2},\frac{1}{3}+\sqrt{7}\right)$, $F_2\left(-\frac{3}{2},\frac{1}{3}-\sqrt{7}\right)$, $B_1\left(\frac{3}{2},\frac{1}{3}\right)$,

$B_2\left(-\frac{9}{2},\frac{1}{3}\right)$, $LR=\frac{9}{2}$, $e=\frac{\sqrt{7}}{4}$, $\overline{V_1V_2}=8$,

$\overline{F_1F_2}=2\sqrt{7}$, $\overline{B_1B_2}=6$

17. $C(-1,2)$, $V_1\left(-\frac{1}{2},2\right)$, $V_2\left(-\frac{3}{2},2\right)$, $F_1\left(-1+\frac{\sqrt{5}}{6},2\right)$,

$F_2\left(-1-\frac{\sqrt{5}}{6},2\right)$, $B_1\left(-1,\frac{7}{3}\right)$, $B_2\left(-1,\frac{5}{3}\right)$, $LR=\frac{4}{9}$,

$e=\frac{\sqrt{5}}{3}$, $\overline{V_1V_2}=1$, $\overline{F_1F_2}=\frac{\sqrt{5}}{3}$, $\overline{B_1B_2}=\frac{2}{3}$

Ejercicio 34

1. $\frac{(x-7)^2}{16}+\frac{(y+2)^2}{4}=1$

$x^2+4y^2-14x+16y+49=0$

2. $\frac{(x-3)^2}{25}+\frac{(y-3)^2}{9}=1$

$9x^2+25y^2-54x-150y+81=0$

3. $\frac{(x+2)^2}{7}+\frac{(y+1)^2}{16}=1$

$16x^2+7y^2+64x+14y-41=0$

4. $\frac{(x-4)^2}{16}+\frac{y^2}{9}=1$

$9x^2+16y^2-72x=0$

5. $\frac{(x-3)^2}{25}+\frac{(y-4)^2}{4}=1$

$4x^2+25y^2-24x-200y+336=0$

6. $\frac{(x-6)^2}{100}+\frac{(y-5)^2}{36}=1$

$9x^2+25y^2-108x-250y+49=0$

7. $\frac{x^2}{5}+\frac{(y+2)^2}{9}=1$

$9x^2+5y^2+20y-25=0$

8. $\frac{(x-3)^2}{4}+\frac{(y+2)^2}{36}=1$

$9x^2+y^2-54x+4y+49=0$

9. $\frac{(x+4)^2}{9}+\frac{(y-1)^2}{25}=1$

$25x^2+9y^2+200x-18y+184=0$

10. $\frac{(x+7)^2}{36}+\frac{(y-5)^2}{4}=1$

$x^2+9y^2+14x-90y+238=0$

11. $\frac{(x+6)^2}{25}+\frac{(y+2)^2}{16}=1$

$16x^2+25y^2+192x+100y+276=0$

12. $\frac{\left(x-\frac{8}{3}\right)^2}{36}+\frac{\left(y+\frac{11}{2}\right)^2}{16}=1$

$144x^2+324y^2-768x+3\,564y+5\,641=0$

13. $\frac{(x-5)^2}{9}+\frac{(y-7)^2}{1}=1$

$x^2+9y^2-10x-126y+457=0$

14. $\frac{(x+4)^2}{16}+\frac{y^2}{7}=1$

$7x^2+16y^2+56x=0$

15. $\frac{(x+1)^2}{25}+\frac{(y-2)^2}{9}=1$

$9x^2+25y^2+18x-100y-116=0$

16. $\frac{(x-3)^2}{64}+\frac{(y-6)^2}{48}=1$

$3x^2+4y^2-18x-48y-21=0$

17. $\frac{(x+5)^2}{36}+\frac{(y-3)^2}{11}=1$

$11x^2+36y^2+110x-216y+203=0$

18. $\frac{(x-2)^2}{4}+\frac{(y-1)^2}{12}=1$

$3x^2+y^2-12x-2y+1=0$

Ejercicio 35

1. Conjunto vacío
2. Punto
3. Elipse
4. Elipse
5. Elipse
6. Conjunto vacío
7. Un punto
8. Un punto
9. Conjunto vacío
10. Elipse

Ejercicio 36

1. $3x^2+8y^2+18x+8y-21=0$
2. $9x^2+4y^2-36x-16y+16=0$
3. $4x^2+y^2-32x-4y+64=0$
4. $x^2+9y^2-18y=0$
5. $4x^2+25y^2-16x-84=0$
6. $x^2+4y^2-16=0$
7. $3x^2+y^2-3=0$
8. $9x^2+25y^2-225=0$
9. $9x^2+4y^2+18x+24y+9=0$
10. $25x^2+4y^2-100x+8y+4=0$

Ejercicio 37

1. 30.0588 UA
2. 0.72298 UA
3. 1.8739 años
4. 11.8578 años
5. $3x-\sqrt{3}y+6=0$
6. $3x+5y-44=0$

Capítulo 10

Ejercicio 38

1. $5x^2-4y^2-20=0$
2. $16x^2-9y^2-144=0$
3. $13y^2-36x^2-468=0$
4. $156y^2-100x^2-975=0$
5. $3x^2-4y^2-12=0$
6. $7x^2-9y^2-70x+72y-32=0$
7. $9y^2-16x^2-96x-36y-252=0$

Ejercicio 39

1. $V(\pm 9, 0)$, $F(\pm 3\sqrt{10}, 0)$, $B(0, \pm 3)$, $\overline{V_1V_2}=18$, $\overline{F_1F_2}=6\sqrt{10}$, $\overline{B_1B_2}=6$, $LR=2$, $e=\frac{\sqrt{10}}{3}$. Asíntotas: $y=\pm\frac{1}{3}x$
2. $V(\pm 1, 0)$, $F(\pm\sqrt{5}, 0)$, $B(0, \pm 2)$, $\overline{V_1V_2}=2$, $\overline{F_1F_2}=2\sqrt{5}$, $\overline{B_1B_2}=4$, $LR=8$, $e=\sqrt{5}$. Asíntotas: $y=\pm 2x$
3. $V(0, \pm 2\sqrt{2})$, $F(0, \pm\sqrt{13})$, $B(\pm\sqrt{5}, 0)$, $\overline{V_1V_2}=4\sqrt{2}$, $\overline{F_1F_2}=2\sqrt{13}$, $\overline{B_1B_2}=2\sqrt{5}$, $LR=\frac{5\sqrt{2}}{2}$, $e=\frac{\sqrt{26}}{4}$. Asíntotas: $y=\pm\frac{2\sqrt{10}}{5}x$
4. $V(0, \pm 2a)$, $F(0, \pm\sqrt{5}a)$, $B(\pm a, 0)$, $\overline{V_1V_2}=4a$, $\overline{F_1F_2}=2\sqrt{5}a$, $\overline{B_1B_2}=2a$, $LR=a$, $e=\frac{\sqrt{5}}{2}$. Asíntotas: $y=\pm 2x$
5. $V(\pm\sqrt{5}, 0)$, $F(\pm 3, 0)$, $B(0, \pm 2)$, $\overline{V_1V_2}=2\sqrt{5}$, $\overline{F_1F_2}=6$, $\overline{B_1B_2}=4$, $LR=\frac{8\sqrt{5}}{5}$, $e=\frac{3\sqrt{5}}{5}$. Asíntotas: $y=\pm\frac{2}{\sqrt{5}}x$
6. $V(\pm 3, 0)$, $F(\pm 5, 0)$, $B(0, \pm 4)$, $\overline{V_1V_2}=6$, $\overline{F_1F_2}=10$, $\overline{B_1B_2}=8$, $LR=\frac{32}{3}$, $e=\frac{5}{3}$. Asíntotas: $y=\pm\frac{4}{3}x$
7. $V(0, \pm 1)$, $F(0, \pm\sqrt{5})$, $B(\pm 2, 0)$, $\overline{V_1V_2}=2$, $\overline{F_1F_2}=2\sqrt{5}$, $\overline{B_1B_2}=4$, $LR=8$; $e=\sqrt{5}$. Asíntotas: $y=\pm\frac{1}{2}x$
8. $V(\pm 5, 0)$, $F(\pm\sqrt{105}, 0)$, $B(0, \pm 4\sqrt{5})$, $\overline{V_1V_2}=10$, $\overline{F_1F_2}=2\sqrt{105}$, $\overline{B_1B_2}=8\sqrt{5}$, $LR=32$; $e=\frac{\sqrt{105}}{5}$. Asíntotas: $y=\pm\frac{4\sqrt{5}}{5}x$
9. $V(0, \pm 4)$, $F(0, \pm 2\sqrt{13})$, $B(\pm 6, 0)$, $\overline{V_1V_2}=8$, $\overline{F_1F_2}=4\sqrt{13}$, $\overline{B_1B_2}=12$, $LR=18$; $e=\frac{\sqrt{13}}{2}$. Asíntotas: $y=\pm\frac{2}{3}x$
10. $V(0, \pm 2)$, $F(0, \pm 2\sqrt{2})$, $B(\pm 2, 0)$, $\overline{V_1V_2}=4$, $\overline{F_1F_2}=4\sqrt{2}$, $\overline{B_1B_2}=4$, $LR=4$; $e=\sqrt{2}$. Asíntotas: $y=\pm x$

11. $V(0, \pm\sqrt{5})$, $F(0, \pm\sqrt{11})$, $B(\pm\sqrt{6}, 0)$, $\overline{V_1V_2} = 2\sqrt{5}$,

$\overline{F_1F_2} = 2\sqrt{11}$, $\overline{B_1B_2} = 2\sqrt{6}$, $LR = \frac{12\sqrt{5}}{5}$,

$e = \frac{\sqrt{55}}{5}$. Asíntotas: $y = \pm\frac{\sqrt{30}}{6}x$

12. $V(\pm\sqrt{5}, 0)$, $F(\pm\sqrt{17}, 0)$, $B(0, \pm 2\sqrt{3})$, $\overline{V_1V_2} = 2\sqrt{5}$,

$\overline{F_1F_2} = 2\sqrt{17}$, $\overline{B_1B_2} = 4\sqrt{3}$, $LR = \frac{24\sqrt{5}}{5}$,

$e = \frac{\sqrt{85}}{5}$. Asíntotas: $y = \pm\frac{2\sqrt{15}}{5}x$

Ejercicio 40

1. $7y^2 - 9x^2 - 63 = 0$
2. $9x^2 - 16y^2 - 144 = 0$
3. $3x^2 - 2y^2 + 12 = 0$
4. $x^2 - 2y^2 - 8 = 0$
5. $4x^2 - y^2 - 4 = 0$
6. $5x^2 - 2y^2 - 40 = 0$
7. $4x^2 - 9y^2 - 36 = 0$
8. $25y^2 - 16x^2 - 400 = 0$
9. $x^2 - 4y^2 - 36 = 0$
10. $x^2 - 3y^2 - 12 = 0$
11. $5y^2 - 6x^2 - 30 = 0$
12. $3x^2 - 4y^2 - 12 = 0$
13. $x^2 - 2y^2 - 12 = 0$
14. $5y^2 - 6x^2 - 30 = 0$
15. $9y^2 - 16x^2 - 256 = 0$
    $16x^2 - 9y^2 - 144 = 0$
16. $x^2 - 9y^2 - 9 = 0$
17. $5x^2 - 6y^2 - 30 = 0$
18. $9x^2 - 4y^2 - 36 = 0$
19. $4x^2 - 9y^2 - 36 = 0$

Ejercicio 41

1. $C(-3, 4)$, $V(-3\pm 5, 4)$, $F(-3\pm\sqrt{34}, 4)$, $B(-3, 4\pm 3)$,

$\overline{V_1V_2} = 10$, $\overline{F_1F_2} = 2\sqrt{34}$, $\overline{B_1B_2} = 6$, $LR = \frac{18}{5}$,

$e = \frac{\sqrt{34}}{5}$. Asíntotas: $y - 4 = \pm\frac{3}{5}(x+3)$

2. $C(-1, 0)$, $V(-1, 0\pm 2)$, $F(-1, 0\pm\sqrt{5})$, $B(-1\pm 1, 0)$,

$\overline{V_1V_2} = 4$, $\overline{F_1F_2} = 2\sqrt{5}$, $\overline{B_1B_2} = 2$, $LR = 1$,

$e = \frac{\sqrt{5}}{2}$. Asíntotas: $y = \pm 2(x+1)$

3. $C(0, -2)$, $V(0\pm 3, -2)$, $F(0\pm\sqrt{13}, -2)$, $B(0, -2\pm 2)$,

$\overline{V_1V_2} = 6$, $\overline{F_1F_2} = 2\sqrt{13}$, $\overline{B_1B_2} = 4$, $LR = \frac{8}{3}$,

$e = \frac{\sqrt{13}}{3}$. Asíntotas: $y + 2 = \pm\frac{2}{3}x$

4. $C(1, 2)$, $V(1, 2\pm\sqrt{2})$, $F(1, 2\pm\sqrt{10})$, $B(1\pm 2\sqrt{2}, 2)$,

$\overline{V_1V_2} = 2\sqrt{2}$, $\overline{F_1F_2} = 2\sqrt{10}$, $\overline{B_1B_2} = 4\sqrt{2}$,

$LR = 8\sqrt{2}$, $e = \sqrt{5}$. Asíntotas: $y - 2 = \pm\frac{1}{2}(x-1)$

5. $C(-1, -3)$, $V(-1, -3\pm 3)$, $F(-1, -3\pm\sqrt{13})$,

$B(-1\pm 2, -3)$, $\overline{V_1V_2} = 6$, $\overline{F_1F_2} = 2\sqrt{13}$, $\overline{B_1B_2} = 4$,

$LR = \frac{8}{3}$, $e = \frac{\sqrt{13}}{3}$. Asíntotas: $y + 3 = \pm\frac{3}{2}(x+1)$

6. $C(-2, 1)$, $V(-2\pm 4, 1)$, $F(-2\pm 5, 1)$, $B(-2, 1\pm 3)$,

$\overline{V_1V_2} = 8$, $\overline{F_1F_2} = 10$, $\overline{B_1B_2} = 6$, $LR = \frac{9}{2}$, $e = \frac{5}{4}$.

Asíntotas: $y - 1 = \pm\frac{3}{4}(x+2)$

7. $C\left(\frac{1}{2}, 1\right)$, $V\left(\frac{1}{2}\pm 3, 1\right)$, $F\left(\frac{1}{2}\pm\sqrt{13}, 1\right)$,

$B\left(\frac{1}{2}, 1\pm 2\right)$ $\overline{V_1V_2} = 6$, $\overline{F_1F_2} = 2\sqrt{13}$, $\overline{B_1B_2} = 4$,

$LR = \frac{8}{3}$, $e = \frac{\sqrt{13}}{3}$. Asíntotas: $y - 1 = \pm\frac{2}{3}\left(x - \frac{1}{2}\right)$

8. $C(-3, 0)$, $V(-3, 0\pm 2)$, $F(-3, 0\pm\sqrt{5})$, $B(-3\pm 1, 0)$,

$\overline{V_1V_2} = 4$, $\overline{F_1F_2} = 2\sqrt{5}$, $\overline{B_1B_2} = 2$, $LR = 1$, $e = \frac{\sqrt{5}}{2}$.

Asíntotas: $y = \pm 2(x+3)$

9. $C\left(\frac{1}{2}, \frac{1}{2}\right)$, $V\left(\frac{1}{2}, \frac{1}{2}\pm 2\right)$, $F\left(\frac{1}{2}, \frac{1}{2}\pm 2\sqrt{2}\right)$,

$B\left(\frac{1}{2}\pm 2, \frac{1}{2}\right)$, $\overline{V_1V_2} = 4$, $\overline{F_1F_2} = 4\sqrt{2}$, $\overline{B_1B_2} = 4$,

$LR = 4$, $e = \sqrt{2}$. Asíntotas: $y - \frac{1}{2} = \pm\left(x - \frac{1}{2}\right)$

10. $C(0, -2)$, $V(0\pm 3, -2)$, $F\left(0\pm 3\sqrt{5}, -2\right)$,

$B(0, -2\pm 6)$, $\overline{V_1V_2} = 6$, $\overline{F_1F_2} = 6\sqrt{5}$, $\overline{B_1B_2} = 12$,

$LR = 24$, $e = \sqrt{5}$. Asíntotas: $y + 2 = \pm 2x$

11. $C(3, -2)$, $V(3\pm 1, -2)$, $F\left(3\pm\sqrt{2}, -2\right)$,

$B(3, -2\pm 1)$, $\overline{V_1V_2} = 2$, $\overline{F_1F_2} = 2\sqrt{2}$, $\overline{B_1B_2} = 2$,

$LR = 2$, $e = \sqrt{2}$. Asíntotas: $y + 2 = \pm(x-3)$

12. $C(2, -2)$, $V(2, -2\pm 3)$, $F\left(2, -2\pm\sqrt{10}\right)$,

$B(2\pm 1, -2)$, $\overline{V_1V_2} = 6$, $\overline{F_1F_2} = 2\sqrt{10}$, $\overline{B_1B_2} = 2$,

$LR = \frac{2}{3}$, $e = \frac{\sqrt{10}}{3}$. Asíntotas: $y + 2 = \pm 3(x-2)$

13. $C\left(\frac{1}{2},\frac{1}{3}\right)$, $V\left(\frac{1}{2}\pm 3,\frac{1}{3}\right)$, $F\left(\frac{1}{2}\pm\sqrt{13},\frac{1}{3}\right)$,

$B\left(\frac{1}{2},\frac{1}{3}\pm 2\right)$, $\overline{V_1V_2}=6$, $\overline{F_1F_2}=2\sqrt{13}$,

$\overline{B_1B_2}=4$, $LR=\frac{8}{3}$, $e=\frac{\sqrt{13}}{3}$.

Asíntotas: $y-\frac{1}{3}=\pm\frac{2}{3}\left(x-\frac{1}{2}\right)$

14. $C(4, 3)$, $V\left(4\pm 2\sqrt{2},3\right)$, $F\left(4\pm 2\sqrt{3},3\right)$,

$B(4, 3\pm 2)$, $\overline{V_1V_2}=4\sqrt{2}$, $\overline{F_1F_2}=4\sqrt{3}$,

$\overline{B_1B_2}=4$, $LR=2\sqrt{2}$, $e=\frac{\sqrt{6}}{2}$.

Asíntotas: $y-3=\pm\frac{\sqrt{2}}{2}(x-4)$

15. $C(-1, -3)$, $V(-1, -3\pm\sqrt{6})$, $F(-1, -3\pm\sqrt{11})$,

$B(-1\pm\sqrt{5}, -3)$, $\overline{V_1V_2}=2\sqrt{6}$, $\overline{F_1F_2}=2\sqrt{11}$,

$\overline{B_1B_2}=2\sqrt{5}$, $LR=\frac{5}{3}\sqrt{6}$, $e=\frac{\sqrt{66}}{6}$.

Asíntotas: $y+3=\pm\frac{\sqrt{30}}{5}(x+1)$

16. $C(-4, -1)$, $V(-4\pm 2, -1)$, $F(-4\pm\sqrt{7}, -1)$,

$B(-4, -1\pm\sqrt{3})$, $\overline{V_1V_2}=4$, $\overline{F_1F_2}=2\sqrt{7}$,

$\overline{B_1B_2}=2\sqrt{3}$, $LR=3$, $e=\frac{\sqrt{7}}{2}$.

Asíntotas: $y+1=\pm\frac{\sqrt{3}}{2}(x+4)$

17. $C(2, 5)$, $V(2\pm 2\sqrt{3}, 5)$, $F(2\pm 3\sqrt{2}, 5)$,

$B(2, 5\pm\sqrt{6})$, $\overline{V_1V_2}=4\sqrt{3}$, $\overline{F_1F_2}=6\sqrt{2}$,

$\overline{B_1B_2}=2\sqrt{6}$, $LR=2\sqrt{3}$, $e=\frac{\sqrt{6}}{2}$.

Asíntotas: $y-5=\pm\frac{\sqrt{2}}{2}(x-2)$

18. $C(-7, -1)$, $V(-7\pm\sqrt{2}, -1)$, $F(-7\pm 2, -1)$,

$B(-7, -1\pm\sqrt{2})$, $\overline{V_1V_2}=2\sqrt{2}$, $\overline{F_1F_2}=4$,

$\overline{B_1B_2}=2\sqrt{2}$, $LR=2\sqrt{2}$, $e=\sqrt{2}$.

Asíntotas: $y+1=\pm 1(x+7)$

19. $C(-7, -1)$, $V(-7\pm 1, -1)$, $F(-7\pm\sqrt{3}, -1)$,

$B(-7, -1\pm\sqrt{2})$, $\overline{V_1V_2}=2$, $\overline{F_1F_2}=2\sqrt{3}$,

$\overline{B_1B_2}=2\sqrt{2}$, $LR=4$, $e=\sqrt{3}$.

Asíntotas: $y+1=\pm\sqrt{2}(x+7)$

20. $C(-1, 5)$, $V(-1\pm\sqrt{3}, 5)$, $F(-1\pm\sqrt{7}, 5)$,

$B(-1, 5\pm 2)$, $\overline{V_1V_2}=2\sqrt{3}$, $\overline{F_1F_2}=2\sqrt{7}$,

$\overline{B_1B_2}=4$, $LR=\frac{8}{3}\sqrt{3}$, $e=\frac{\sqrt{21}}{3}$.

Asíntotas: $y-5=\pm\frac{2\sqrt{3}}{3}(x+1)$

Ejercicio 42

1. $16x^2-9y^2+18y-153=0$
2. $11y^2-25x^2+22y-200x-664=0$
3. $9x^2-16y^2-36x-64y-172=0$
4. $5y^2-4x^2-30y+8x+21=0$
5. $9x^2-16y^2-54x+64y-127=0$
6. $5x^2-4y^2+60x+24y+124=0$
7. $3x^2-y^2-12x+6y-9=0$
8. $9x^2-7y^2+18x+42y+9=0$
9. $x^2-2y^2-8x+12y-10=0$
10. $6x^2-5y^2+24x-30y+9=0$
11. $3x^2-4y^2+24x-8y+32=0$
12. $9x^2-16y^2-18x+96y-279=0$
13. $4y^2-5x^2-8y-10x-21=0$
14. $9x^2-4y^2+36x+8y-4=0$

Ejercicio 43

1. $k=5$	5. $k=1$	9. $k=0$
2. $k=-2$	6. $k=1$	10. $k=-7$
3. $k=77$	7. $k=64$	11. $k=-32$
4. $k=-\frac{1}{6}$	8. $k=-35$	

Ejercicio 44

1. $5x-4y+16=0$	4. $2x-5y-30=0$
2. $5x+\sqrt{34}\,y+25=0$	5. $x+4y-9=0$
3. $5x-4y+26=0$	

CAPÍTULO 11

EJERCICIO 45

1. $y'^2 - \sqrt{2}\,x = 0$
2. $3x'^2 + 4y'^2 - 12 = 0$
3. $x'^2 - y'^2 + 4 = 0$
4. $x'^2 + y' = 0$
5. $x'^2 + 2y'^2 + 4x' + 4y' - 3 = 0$

EJERCICIO 46

1. $x'^2 - y'^2 - 1 = 0$
2. $y'^2 - 8x' = 0$
3. $x'^2 + 4y'^2 - 4x' - 8y' + 4 = 0$
4. $x'^2 - \sqrt{3}\,y' = 0$
5. $x'^2 - y'^2 - 2 = 0$
6. $4x'^2 + 9y'^2 + 8\sqrt{2}\,x' - 28 = 0$
7. $3x'^2 + y'^2 - 2\sqrt{2}\,x' - 10\sqrt{2}\,y' + 10 = 0$
8. $6x'^2 + y'^2 - 6\sqrt{5}\,x' + 8\sqrt{5}\,y' = 0$
9. $2y'^2 - 5\sqrt{2}\,x' + 15\sqrt{2}\,y' = 0$
10. $3x'^2 - y'^2 - 24\sqrt{2}\,x + 104 = 0$

EJERCICIO 47

1. $y''^2 - 4x'' = 0$
2. $4x''^2 + y''^2 - 4 = 0$
3. $4x''^2 + 9y''^2 - 36 = 0$
4. $4x''^2 - 9y''^2 - 36 = 0$
5. $x''^2 + 8y'' = 0$
6. $y''^2 + 6x'' = 0$
7. $x''^2 - y''^2 + 9 = 0$
8. $x''^2 - 12y'' = 0$
9. $4x''^2 + y''^2 - 4 = 0$

EJERCICIO 48

1. Parábola
2. Elipse
3. Hipérbola
4. Parábola
5. Elipse
6. Parábola
7. Elipse
8. Elipse
9. Parábola
10. Hipérbola

EJERCICIO 49

1. $x - y + 3 = 0$; $x + 2y = 0$
2. $3x + y + 1 = 0$
3. $x - y + 1 = 0$
4. $x + y + 3 = 0$; $4x - y + 7 = 0$
5. $3x - 2y = 0$; $x + y = 0$
6. $x + 5y - 2 = 0$
7. $P(-1, -1)$
8. $3x + 4y - 2 = 0$
9. $x + 3y - 2 = 0$; $x - 2y + 2 = 0$
10. $2x + 3y - 5 = 0$

EJERCICIO 50

1. $5x^2 + 9y^2 + 48x - 54y - 63 = 0$
2. $4x^2 + 3y^2 - 8x - 12y + 4 = 0$
3. $y^2 + 14x - 6y - 12 = 0$
4. $16x^2 - 9y^2 + 200y - 400 = 0$
5. $x^2 - 16xy + y^2 - 36x + 18y + 45 = 0$
6. $3x^2 + 4xy - 18x - 2y - 4 = 0$
7. $144x^2 + 432xy + 324y^2 + 984x - 1\,332y - 1\,127 = 0$
8. $2xy + a^2 = 0$
9. $7y^2 - 24xy - 6y + 144x - 225 = 0$
10. $x^2 + 4y^2 - 6\sqrt{3}\,ax + 11a^2 = 0$

EJERCICIO 51

1. $x = \pm\frac{25}{3}$
2. $y = \pm\frac{16}{\sqrt{7}}$
3. $x = \pm\frac{9}{\sqrt{5}}$
4. $x = \pm\frac{4}{\sqrt{29}}$
5. $y = \pm\frac{16}{5}$
6. $y = \pm\frac{25}{\sqrt{34}}$
7. $y = -2 \pm \frac{9}{\sqrt{5}}$
8. $x = -3 \pm \frac{25}{\sqrt{41}}$
9. $x = \pm\frac{\sqrt{2}}{2}$
10. $y = 1 \pm \frac{16}{\sqrt{7}}$

EJERCICIO 52

1. $3x + 4y - 25 = 0$
2. $9x + 4y - 31 = 0$
3. $5x - 4y - 21 = 0$
4. $6x - 5y + 31 = 0$
5. $12x - 5y - 38 = 0$
6. $x - 4y + 17 = 0$
7. $3x - 5y + 18 = 0$
8. $y - 2 = 0$
9. $x - y - 7 = 0$
10. $16x + 25y + 41 = 0$

EJERCICIO 53

1. $3x - 2y + 13 = 0$; $3x - 2y - 13 = 0$
2. $2x - 3y + 3\sqrt{5} = 0$; $2x - 3y - 3\sqrt{5} = 0$
3. $x - 6y + 14 = 0$
4. $x + 2y + 1 = 0$
5. $x + 4y - 3 = 0$, $x + 4y + 9 = 0$

EJERCICIO 54

1. $x - y + 2 = 0$; $x + 2y + 8 = 0$
2. $y = 0$, $2x + y + 8 = 0$
3. $\sqrt{3}x - 3y + 6 = 0$; $\sqrt{3}x + 3y - 6 = 0$
4. $3x - 5y + 18 = 0$; $5x + 3y - 38 = 0$
5. $2x - y + 1 = 0$; $x + y - 4 = 0$

CAPÍTULO 12

EJERCICIO 55

1. $A\left(3\sqrt{2},3\sqrt{2}\right)$
2. $R\left(2,-2\sqrt{3}\right)$
3. $P\left(-4,4\right)$
4. $A\left(4\sqrt{3},4\right)$
5. $B\left(5,-5\sqrt{3}\right)$
6. $C\left(0,-4\right)$
7. $Q\left(\frac{5}{2},\frac{5}{2}\sqrt{3}\right)$
8. $M\left(-\frac{7}{2}\sqrt{2},\frac{7}{2}\sqrt{2}\right)$
9. $N\left(5\sqrt{2},5\sqrt{2}\right)$
10. $S\left(-\frac{15}{2}\sqrt{3},\frac{15}{2}\right)$
11. $T\left(\frac{3}{2},-\frac{3}{2}\sqrt{3}\right)$
12. $A\left(-1,\sqrt{3}\right)$
13. $S\left(-\frac{\sqrt{3}}{4},\frac{1}{4}\right)$
14. $C\left(\frac{3}{2},\frac{\sqrt{3}}{2}\right)$
15. $B\left(-\frac{3}{8}\sqrt{2+\sqrt{3}},-\frac{3}{8}\sqrt{2-\sqrt{3}}\right)$
16. $A(13, 67°22'48'') = (-13, 247°22'48'')$
17. $P\left(2\sqrt{13}, 213°41'24''\right) = \left(-2\sqrt{13}, 33°41'24''\right)$
18. $C(5, 323°7'48'') = (-5, 143°7'48'')$
19. $B(15, 306°52'11'') = (-15, 126°52'11'')$
20. $C(4, 0°) = (-4, 180°)$
21. $W(6, 270°) = (-6, 90°)$
22. $M(5, 306°52'11'') = (-5, 126°52'11'')$
23. $Q(13, 157°22'48'') = (-13, 337°22'48'')$
24. $D(-1, 135°) = (1, 315°)$
25. $F(25, 16°15'36'') = (-25, 196°15'36'')$
26. $Z(1, 150°) = (-1, 330°)$
27. $Q(\sqrt{34}, 329°2'10'') = (-\sqrt{34}, 149°2'10'')$
28. $L(3, 180°) = (-3, 0°)$
29. $J\left(\frac{\sqrt{17}}{2}, 284°2'10''\right) = \left(-\frac{\sqrt{17}}{2}, 104°2'10''\right)$
30. $K(5, 90°) = (-5, 270°)$

EJERCICIO 56

1. $d_{AB} = \sqrt{5}\ u$
2. $d_{CD} = 3\sqrt{5}\ u$
3. $d_{EF} = 17\ u$
4. $d_{GH} = 2\sqrt{7}\ u$
5. $d_{IJ} = \sqrt{89-40\sqrt{3}}\ u$
6. $A = 36u^2$
7. $A = 6u^2$
8. $A = 32u^2$

EJERCICIO 57

1. $r\ sen\ \theta + 3 = 0$
2. $r\ cos\ \theta - 5 = 0$
3. $\theta = 60°$
4. $r = \frac{6}{2cos\ \theta - 3sen\ \theta}$
5. $r = \frac{2}{sen\ \theta + cos\ \theta}$
6. $r = \frac{p}{cos(\theta - w)}$
7. $r = \pm 4$
8. $r + 4\ cos\ \theta = 0$
9. $r - 2\ sen\ \theta = 0$
10. $r^2 - 4\ r\ cos\ \theta - 6\ r\ sen\ \theta - 12 = 0$
11. $r = \frac{-8cos\ \theta}{sen^2\ \theta} = -8cot\ \theta\ csc\ \theta$
12. $r^2\ sen^2\ \theta - 12\ r\ cos\ \theta - 36 = 0$
13. $r = sen2\ \theta$
14. $r^2\ cos^2\ \theta - 2r\ cos\ \theta - 4r\ sen\ \theta - 3 = 0$
15. $r = \frac{\pm 6}{\sqrt{5cos^2\theta + 4}}$
16. $r = \frac{\pm 20}{\sqrt{16 + 9sen^2\theta}}$
17. $9r^2\ cos^2\ \theta + 25r^2\ sen^2\ \theta - 72r\ sen\ \theta - 81 = 0$
18. $r = \frac{-36sen\ \theta}{4 + 5sen^2\ \theta}$
19. $r = \frac{\pm 3}{\sqrt{cos\ 2\theta}}$
20. $r = \frac{\pm 12}{\sqrt{25cos^2\ \theta - 9}}$
21. $9r^2\ cos^2\ \theta - 4r^2\ sen^2\ \theta + 8r\ sen\ \theta - 40 = 0$
22. $r = cos\ \theta \pm 1$
23. $r = \pm\sqrt{\frac{-8}{sen\ 2\theta}}$
24. $r = \pm\sqrt{cos\ 2\theta}$
25. $r = \frac{1}{2}sen\ 2\theta$
26. $r\ cos^2\ \theta\ (r\ sen\ \theta - 2) = 16sen\ \theta$
27. $r = 12\ ctg\ \theta\ csc\ \theta$
28. $r = \frac{12}{3sen\ \theta - 4cos\ \theta}$
29. $r = \frac{\pm 4}{\sqrt{cos^2\ \theta - 4sen^2\ \theta}}$

30. $r^2 cos^2 \theta + 4r\, sen\, \theta - 8 = 0$

31. $r = -3sen\, \theta \pm 2$

32. $r = \dfrac{\pm 6}{\sqrt{4 + 5sen^2 \theta}}$

33. $r^2 - 2r\, cos\, \theta = 8$

34. $r^2 (3 + sen^2\, \theta) - 6r\, cos\, \theta - 9 = 0$

35. $r^2 (4 - 9\, cos^2\, \theta) - 8r\, sen\, \theta - 6 = 0$

36. $r^2 cos^2\, \theta - 5r\, sen\, \theta + 15 = 0$

37. $r = \dfrac{2 - 4ctg\, \theta}{3sen\, \theta}$

38. $r = \dfrac{\pm 2\sqrt{2}}{\sqrt{2cos\, 2\theta + 3sen\, 2\theta}}$

39. $r = \dfrac{1 \pm \sqrt{1 + tan\, \theta}}{cos\, \theta}$

40. $\dfrac{1}{2} r^2\, sen2\, \theta - r\, sen\, \theta - 3r\, cos\, \theta + 2 = 0$

Ejercicio 58

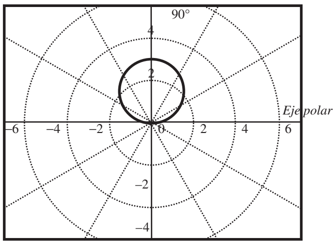
1. $y - 5 = 0$
2. $x + 8 = 0$
3. $x^2 + 2y^2 - 4x = 0$
4. $x^2 + y^2 - 4y = 0$
5. $9x^2 + 5y^2 + 20y - 25 = 0$
6. $\left(x^2 + y^2\right)^{\frac{3}{2}} - 2xy = 0$
7. $x^2 + 2y^2 - 256 = 0$
8. $y^2 - 10x - 25 = 0$
9. $4(x^2 + y^2) = (x^2 + y^2 + x)^2$
10. $x^4 + y^4 - 15x^2 - 16y^2 + 2x^2y^2 - 2x^3 - 2xy^2 = 0$
11. $16(x^2 + y^2) = (x^2 + y^2 + 4x)^2$
12. $2xy - 9 = 0$
13. $x^2 - 6y - 9 = 0$
14. $y^2 + 8x - 16 = 0$
15. $\left(x^2 + y^2\right)^{\frac{3}{2}} = 4\left(x^2 - y^2\right)$
16. $\left(x^2 + y^2\right)^{\frac{3}{2}} = y$
17. $9x^2 + 8y^2 + 12y - 36 = 0$
18. $3x^2 + 4y^2 - 4x - 4 = 0$
19. $3x^2 - y^2 + 12x + 9 = 0$
20. $3x^2 + 4y^2 + 2x - 1 = 0$
21. $3x^2 + 4y^2 - 8x - 16 = 0$
22. $\left(x^2 + y^2\right)^2 = 16\left(x^2 - y^2\right)$
23. $5x^2 - 4y^2 - 36x + 36 = 0$
24. $x^2 + 4y - 4 = 0$
25. $4x^3 - y^2 = 0$
26. $x^2 + y^2 - 5x + 3y - 8 = 0$
27. $x^2 + 3x - 2y + 4 = 0$
28. $y^2 - 12x = 0$
29. $x^2 - y^2 = 1$
30. $x + \sqrt{3}\, y + 8 = 0$
31. $x - \sqrt{3}\, y = 0$
32. $\left(x^2 + y^2\right)^2 = x^3 - 3xy^2$
33. $(x^2 + y^2)^2 = 2x^3 - 6xy^2$
34. $\left(x^2 + y^2\right)^2 \left[\sqrt{x^2 + y^2} - 5\right] = -40x^2y^2$
35. $x\, tan\, \dfrac{\sqrt{x^2 + y^2}}{3} - y = 0$
36. $2\left(x^2 + y^2\right)^{\frac{3}{2}} - 9\left(x^2 + y^2\right)^{\frac{1}{2}} + 9x = 0$
37. $2\left(x^2 + y^2\right)^{\frac{3}{2}} - 4\left(x^2 + y^2\right) + \sqrt{x^2 + y^2} - x = 0$

Ejercicio 59

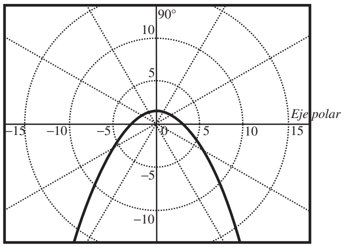
1.	Parábola horizontal	11.	Hipérbola vertical
2.	Parábola horizontal	12.	Parábola vertical
3.	Parábola vertical	13.	Hipérbola horizontal
4.	Parábola vertical	14.	Elipse horizontal
5.	Elipse vertical	15.	Parábola horizontal
6.	Hipérbola vertical	16.	Elipse horizontal
7.	Elipse horizontal	17.	Elipse horizontal
8.	Elipse horizontal	18.	Elipse vertical
9.	Hipérbola horizontal	19.	Parábola vertical
10.	Hipérbola horizontal	20.	Elipse vertical

Ejercicio 60

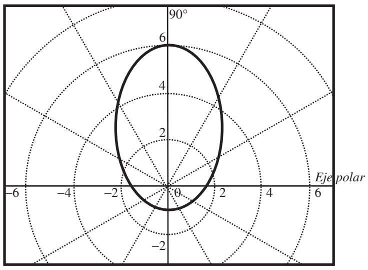
1. $r = 3\, sen\, \theta$



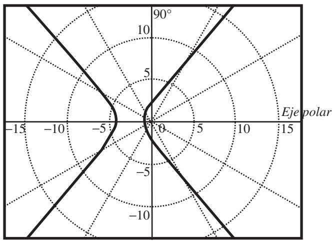
2. $r = \dfrac{3}{1 + sen\,\theta}$



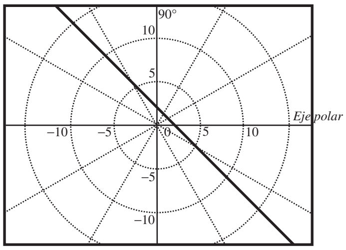
3. Elipse



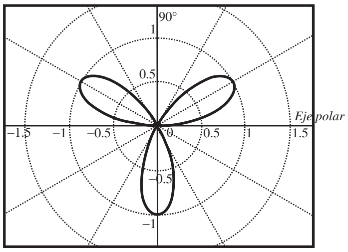
4. $\dfrac{4}{2 - 3cos\,\theta}$



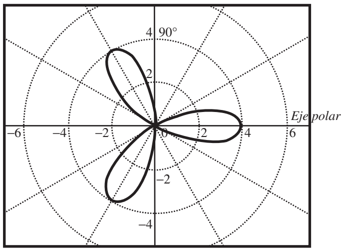
5. $r = \dfrac{2}{sen\,\theta + cos\,\theta}$



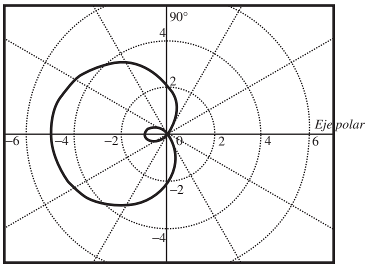
6. $r = sen\,3\theta$



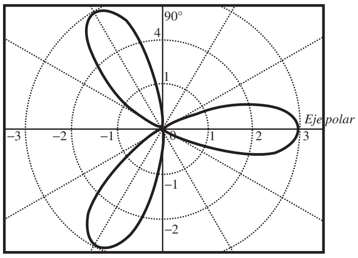
7. $r = 4cos\,3\theta$



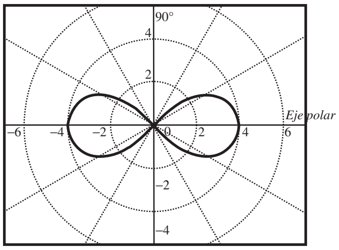
8. $r = 2 - 3cos\,\theta$



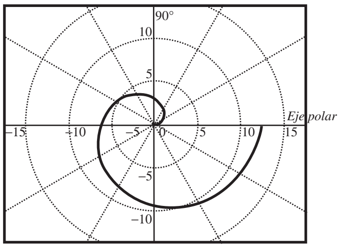
9. $r = 3cos\,3\theta$



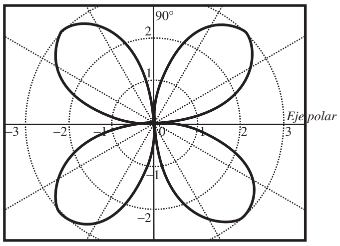
10. $r^2 = 16cos\,2\theta$



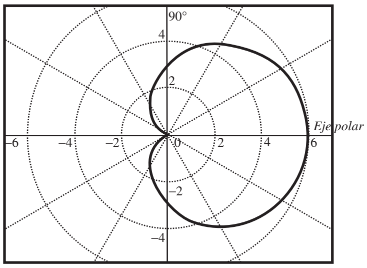
11. $r = 2\theta$



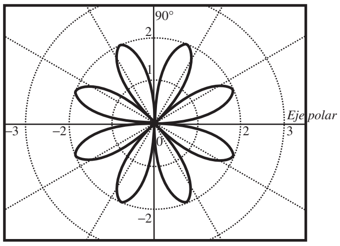
12. $r = 3sen\ 2\theta$



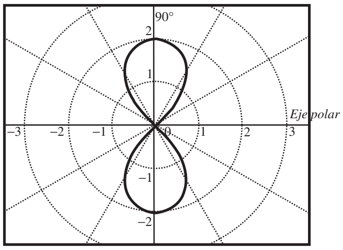
13. $r = 3(1 + cos\ \theta)$



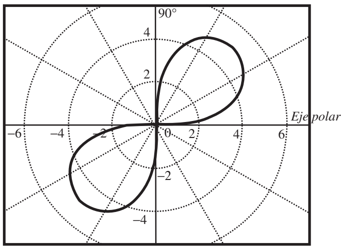
14. $r = 2sen\ 4\theta$



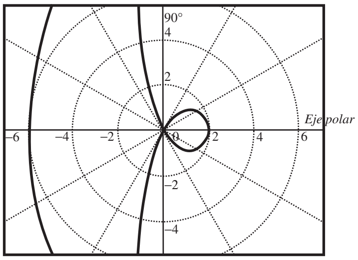
15. $r^2 = -4cos\ 2\theta$



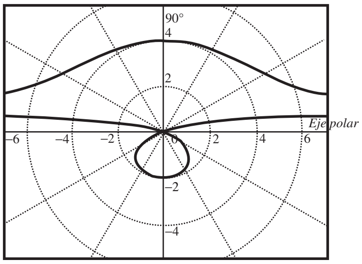
16. $r^2 = 25sen\ 2\theta$



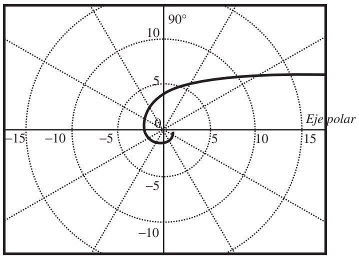
17. $r = 4 - 2sec\ \theta$



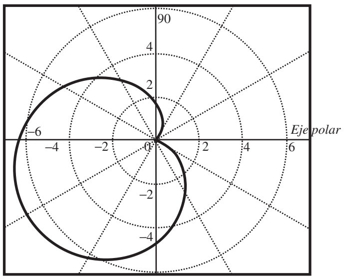
18. $r = 3 + csc\ \theta$



19. $r = \dfrac{2\pi}{\theta}$



20. $r = \theta\,(1 - cos\ \theta)$



EJERCICIO 61

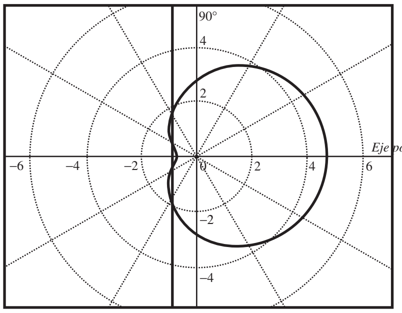
1. $r \cos \theta - 5 = 0$
2. $r \operatorname{sen} \theta + 7 = 0$
3. $r \operatorname{sen} \theta - 5 = 0$
4. $r \cos \theta + 1 = 0$
5. $r \cos(\theta - 60º) = 5\sqrt{3}$
6. $r \cos(\theta - 75º) = 4\sqrt{2}$
7. $r \cos(\theta - 150º) = 2$
8. $r \cos(\theta - 135º) = 5$

EJERCICIO 62

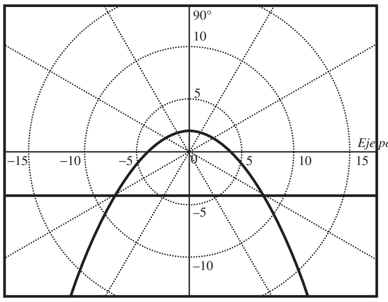
1. $r^2 - 6r \cos(\theta - 30º) - 72 = 0$
2. $r^2 - 10r \cos(\theta - 120º) + 24 = 0$
3. $r^2 - 20r \cos(\theta - 45º) + 84 = 0$
4. $r - 14 \operatorname{sen} \theta = 0$
5. $r - 6 = 0$

EJERCICIO 63

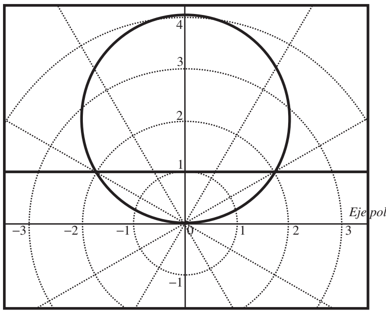
1. $(1, 30°)$, $\left(-\sqrt{3}, 60°\right)$, $\left(\sqrt{3}, 300°\right)$, $(-1, 330°)$



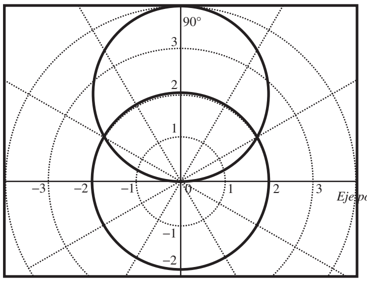
2. $(8, 210°)$, $(8, 330°)$



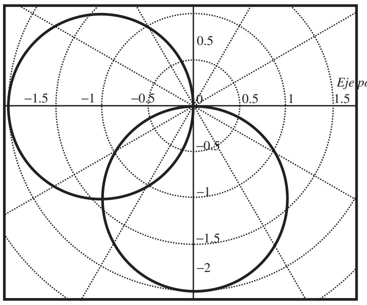
3. $(2, 30°)$, $(2, 150°)$



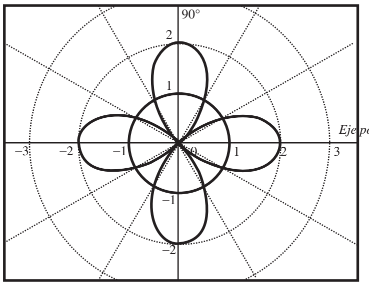
4. $(2, 30°)$, $(2, 150°)$



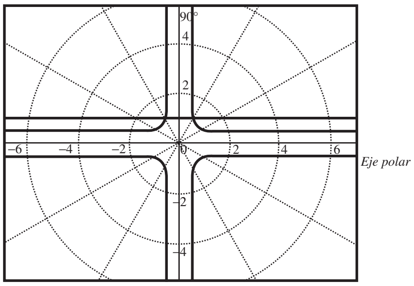
5. $(-\sqrt{2}, 45°)$, $(\sqrt{2}, 225°)$



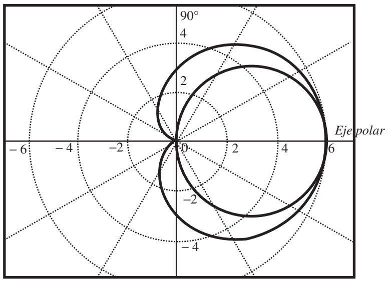
6. $(1, 30°)$, $(1, 330°)$, $(1, 150°)$, $(1, 210°)$



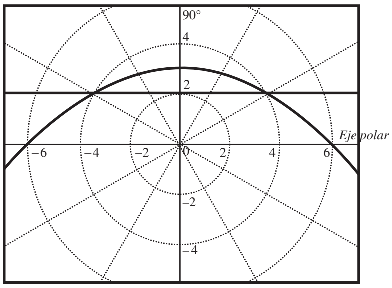
7. $\left(\frac{2}{\sqrt{3}}, 60°\right)$, $\left(-\frac{2}{\sqrt{3}}, 300°\right)$



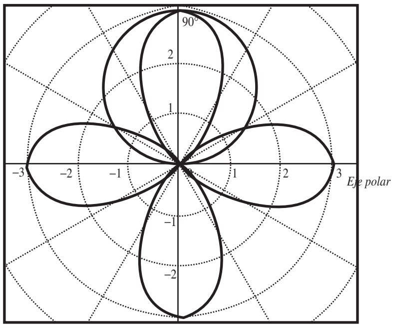
8. (6, 0°)



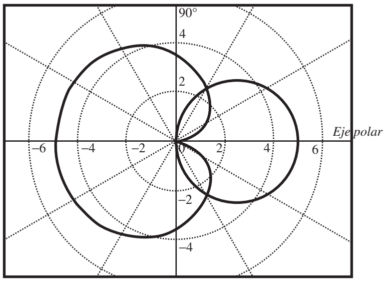
9. (4, 30°), (4, 150°)



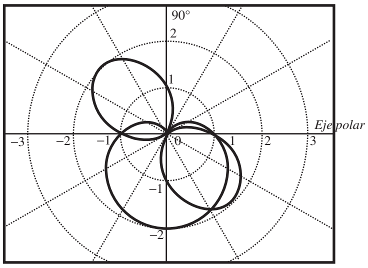
10. $\left(\frac{3}{2}, 30°\right)$, $\left(\frac{3}{2}, 150°\right)$



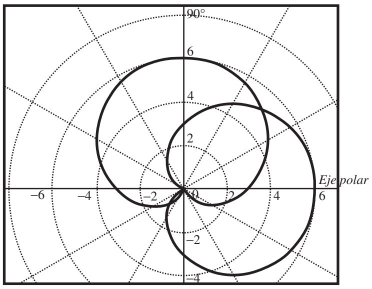
11. $\left(\frac{5}{2}, 60°\right)$, $\left(\frac{5}{2}, 300°\right)$



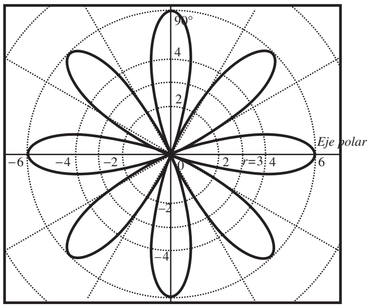
12. (1, 0°), (1, 180°), (1.8, 300°), (0.13, 60°)



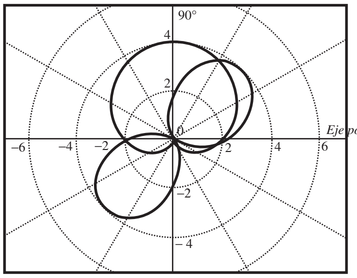
13. $\left(\frac{3}{2}\left(2+\sqrt{2}\right), 45°\right)$, $\left(\frac{3}{2}\left(2-\sqrt{2}\right), 225°\right)$



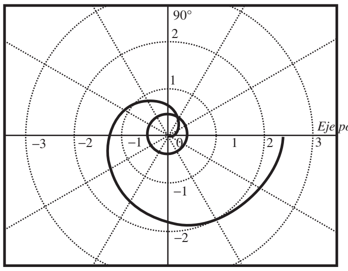
14. (3, 15°), (3, 75°), (3, 105°), (3, 165°), (3, 195°), (3, 255°), (3, 285°), (3, 345°)



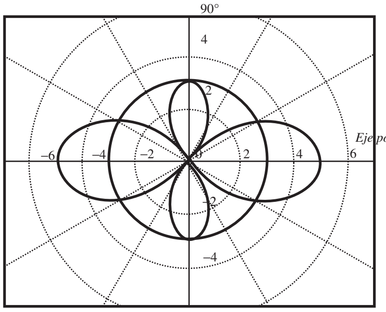
15. (2, 0°), (2, 180°), (3.7, 60°), (0.26, 300°)



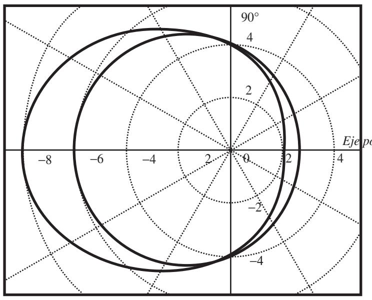
16. (2, 60°)



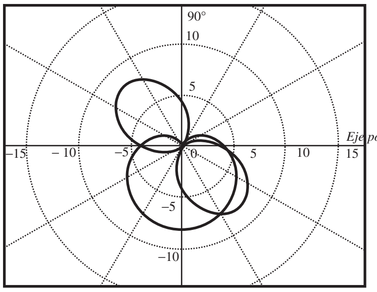
17. (3, 30°), (3, 150°), (3, 210°), (3, 330°)



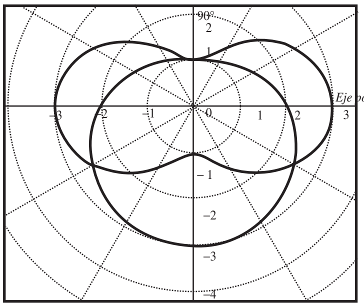
18. (4, 90°), (4, 270°)



19. (4, 0°), (4, 180°), $(4-2\sqrt{3}$, 60°), $(4+2\sqrt{3}$, 300°)



20. (1, 90°), (2.5, 210°), (2.5, 330°)



CAPÍTULO 13

EJERCICIO 64

1. $x - 4y = 0$
2. $\dfrac{x-b}{a} = \dfrac{y+d}{c}$
3. $2bx - ay - 2ab = 0$
4. $3x + 4y - 2 = 0$
5. $2x - y - 2 = 0$
6. $y^2 - x + 4y + 3 = 0$
7. $x^2 - 4x - y + 8 = 0$
8. $2x - y - 1 = 0$
9. $2x^3 - y + 20 = 0$
10. $y^2 - x - 1 = 0$
11. $y^2 - 16x - 2y - 31 = 0$
12. $xy^2 - 2xy + x - y = 0$
13. $x^3 - 2y - 2 = 0$
14. $3x^2 - 21xy + 18y^2 - 25 = 0$
15. $4x^2 + y^2 + x = 0$
16. $y^2 - x^2 - 4y = 0$
17. $x^2 + y^2 = 16$
18. $x^2y + x^2 - y - 4 = 0$
19. $xy = 1$, $xy = -1$
20. $\left(3y^2+2\right)^2\left(2-x\right) = 1$
21. $y = \dfrac{1}{1-3x}$
22. $y = \left(x-1\right)^{\frac{2}{3}}$
23. $xy = 1$

Ejercicio 65

1. $\frac{x^2}{16}+\frac{y^2}{49}=1$
2. $\frac{x^2}{4}+\frac{y^2}{16}=1$
3. $x^2+y^2=4$
4. $\frac{y^2}{b^2}-\frac{x^2}{a^2}=1$
5. $xy=128$
6. $x^2-y^2+1=0$
7. $4x-y+4=0$
8. $2y^2+x-1=0$
9. $x^4-4x^2+y^2=0$
10. $y=3x-4x^3$
11. $\frac{(x-1)^2}{4}+\frac{(y-2)^2}{9}=1$
12. $x^2+y^2-6x-6y+17=0$
13. $4x^2+9y^2-16x+18y-11=0$
14. $4x^2+y^2-32x-6y+69=0$
15. $x=(y-1)(xy-x+2)$
16. $(x-1)^2-y^2=4$
17. $5x^2+4xy+8y^2-36=0$
18. $x^2-8xy+17y^2-2=0$
19. $x-y+5=0$
20. $9x^2-4y^2+16y-52=0$
21. $y^2-2xy=8$